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# INDIVIDUAL MUSIC THERAPY FOR MANAGING NEUROPSYCHIATRIC SYMPTOMS IN DEMENTIA CARE HOMES

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ABSTRACT

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Individual music therapy for managing neuropsychiatric symptoms in dementia care homes

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## Abstract

Previous research highlights the importance of staff involvement in psychosocial interventions targeting neuropsychiatric symptoms of dementia. Music therapy has shown potential effects, but it is not clear how this intervention can be programmed to involve care staff within the delivery of patients' care. There is also a paucity of research into the mechanism of music therapy sessions and the role of music therapists within the context of care. This study reports initial feasibility and outcomes from a five month music therapy programme, which included weekly individual active music therapy for people with dementia and weekly post-therapy video presentations for their carers in care homes. Furthermore, the study employed video analysis to explore the core components of individual music therapy sessions and how these components impact on symptoms.

A mixed-methods research design was employed throughout this two-phased study. The first phase involved a randomised controlled feasibility study. 17 care home residents and 10 care staff were randomised to the music therapy intervention group or standard care control group. The feasibility study included baseline, 3-month, 5-month and post-intervention 7-month measures of residents' symptoms and well-being. Carer-resident interactions were also assessed. Feasibility was based on carers' feedback through semi-structured interviews, programme evaluations and track records of the study. The second phase involved two case studies. The case studies employed video analysis of the therapy sessions to report two of the trial participants' behaviours and the indices of heart rate and heart rate variability implicated in these behaviours.

The music therapy programme appeared to be a practicable and acceptable intervention for care home residents and staff in managing dementia symptoms. Recruitment and retention data indicated feasibility but also challenges. Preliminary outcomes indicated differences in symptoms (13.42, 95 % CI: [4.78 to 22.07; p = 0.006]) and in levels of wellbeing (−0.74, 95 % CI: [−1.15 to −0.33; p = 0.003]) between the two groups, indicating that residents receiving music therapy improved. Staff in the intervention group reported enhanced caregiving techniques as a result of the programme. The results of the hermeneutic analysis of the video excerpts shed light on symptom reduction as a result of emotion regulation within therapist-client interaction during the therapy sessions.

The data supports the value of developing a music therapy programme involving weekly active individual music therapy sessions and music therapist-carer communication. The results also indicate that emotion regulation may serve to be the theoretical model of individual music therapy, which enables an educational role of music therapists within the care team in care homes. Furthermore, the results indicate the feasibility of implementing the current trial design, with modifications, in a more rigorous evaluation of a larger sample size.

Keywords: Music therapy, Caregiving, Neuropsychiatric symptoms, Dementia, Emotion regulation

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## Enclosed materials

A Dropbox link is set up for accessing the 16 video excerpts in the study. Due to confidentiality, the excerpts are only used for the examination of the thesis.

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## List of abbreviations

| | |
|---|---|
| ACC | Anterior Cingulate Cortex |
| AD | Alzheimer's Disease |
| ANOVA | Analysis of Variance, a statistical method for comparing multiple means across different groups |
| ANS | Autonomic Nervous System, a division of the peripheral nervous system that regulates bodily functions, such as breathing, the heartbeat, digestive processes without a person's conscious effort |
| arMFC | anterior rostral MedioFrontal Cortex |
| BOLD | Blood Oxygen Level Dependent signals |
| CI | Confidence Interval measures the probability that a population parameter will fall between two set values |
| CMAI | Cohen-Mansfield Agitation Inventory |

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|---|---|
| DCM | Dementia Care Mapping, a systematic observational tool to understand the mood and engament of a person with dementia during various activities in daily care |
| DCM-PE | Personal Enhaners in Dementia Care Mapping, any interaction that has a positive experience on the person and their well-being |
| EBA | Extrastriate Body Area, located at the posterior inferior temporal sulcus/middle temporal gyrus, which perceives human bodies in relation to body parts |
| FBA | Fusiform Body Area, located at the ventral part of the fusiform gyrus and involved in the visual processing of human bodies |
| FFA | Fusiform Face Area, a cortical region specialised for the perception of faces |
| GDS | Global Deterioration Scale, an assessment tool to provide an overview of the stages of cognitive function for people with dementia |
| HF | High-Frequency band of heart rate variability that ranges from 0.15 to 0.4 hertz |
| HR | Heart Rate |
| HR STD | Standard Deviation of instantaneous heat rate values |
| HRV | Heart Rate Variability, the variation in the time interval between heartbeats |
| Hz | Hertz, a unit of frequency, defined as one cycle per second |
| IFC | Inferior Frontal Cortex |
| LF | Low-Frequency band of heart rate variability that ranges from 0.04 to 0.015 hertz |
| lIPL | left Inferior Parietal Lobule |
| Mean HR | Mean Heart Rate |
| MPFC | Medial Prefrontal Cortex |
| Mean RR | Mean RR interval, the mean of the intervals between heartbeats, specified by millisecond |
| m-STC | mid-Superior Temporal Cortex |

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| NN50 | Number of successive Normal-to-Normal interval pairs that differ by more than 50 milliseconds |
| NPI | Neuropsychiatric Inventory, a validated outcome measure for assessing the frequency and severity of neuropsychiatric symptoms of dementia |
| NPI-NH | Neuropsychiatric Inventory-Nursing Home version |
| NPS | Neuropsychiatric Symptoms |
| OFC | Orbitofronal Cortex |
| PMC | Premotor Cortex |
| pNN50 | NN50 divided by the total number of heartbeat intervals |
| PNS | Parasympathetic Nervous System, a division of the autonomic nervous system that promotes calming of the nerves, rest and digest, slows heart rate and decreases blood pressure |
| p-STC | posterior Superior Temporal Cortex |
| RCT | Randomised Controlled Trial |
| RMSSD | Root Mean Square of Successive Differences of interbeat intervals |
| rSTS | right Superior Temporal Sulcus |
| s.d. | Standard Deviation |
| SDNN | Standard Deviation of Normal-to-Normal intervals of heartbeats |
| SMA | Supplementary Motor Area |
| SNS | Sympathetic Nervous System, a division of the autonomic nervous system which promotes a fight-or-flight response in accordanc with arousal and energy generation |
| STS | the Superior Temporal Sulcus, the sulcus separating the superior temporal gyrus from the middle temporal gyrus |
| TVA | Temporal Voice Area, a voice-sensitive region in the auditory cortex |
| VDB | Verbal Disruptive Behaviour |

| | |
|---|---|
| VTA | Ventral Tegmental Area |

## Copyright declaration

# Chapter 1 Introduction

## 1.1 Context of the study

### 1.1.1 Musical memory

> *"And I shall call to mind how it was always celebrated and held sacred among the ancients, and how very sage philosophers were of opinion that the world is composed of music, that the heavens make their harmony in their moving, and that the soul, being ordered in like fashion, awakes, and as it were revives its power through music" (Castiglione, 1528, from The Book of the Courtier, translated by Singleton in 1959)*

The power of music and its impact on the human mind has been phenomenally documented since ancient times. However, humans' innate ability to respond to, decode and memorise music is an even more perplexing phenomenon, which has spurred growing volumes of research into the evolutionary, cognitive, physiological and social domains of musicality (Tervaniemi et al., 1997; Peretz and Zatorre, 2003; Malloch and Trevarthen, 2009; Mithen, 2009). The manifestation of musicality in a real life situation often leaves people in awe. An example of this is demonstrated in a story of pianist Maria João Pires; during a concert, as soon as the orchestra began playing, Maria realised she had learned the wrong Mozart Piano Concerto. Miraculously, she managed to recall and play the correct piece on the spot, without missing a single note[1]. This has also been observed in clinical populations. The viral YouTube video of Henry[2] shows a nursing home resident, who requires care support for his seizures and normally seems subdued, lights up, as if he 'comes alive', when listening to music from his past. These accounts of intrinsic musicality all appear to highlight one celebrated cognitive function – musical memory.

Musical memory is found to be preserved until later stage of dementia, whilst all other cognitive abilities deteriorate (Jacobsen et al., 2015). It involves semantic

[1] Classic FM, 2014. Remember when Maria João Pires almost played the wrong piano concerto? [online] Available at: < http://www.classicfm.com/artists/maria-joao-pires/guides/wrong-piano-concerto/> [Accessed 06 February 2017].

[2] Music & Memory, 2012 Alive Inside Film of Music and Memory Project - Henry's Story. [video online] Available at: < https://www.youtube.com/watch?v=5FWn4JB2YLU> [Accessed 06 February 2017].

memory, which allows a person with dementia to recognise the melody, lyrics, title and emotions of a song (Cuddy and Duffin, 2005; Drapeau et al., 2009; Samson, Dellacherie and Platel, 2009; Vanstone and Cuddy, 2009; 2012; Hsieh et al., 2011; 2012; Johnson, Chang and Brambati, 2011) as well as procedural memory, which accesses previously learned motor skills, such as singing or playing a tune on an instrument (Baird and Samson, 2009). Music-evoked autobiographical memory (Bartlett and Snelus, 1980; Schulkind et al., 1999; Janata, Tomic and Rakowski, 2007) is another type of memory associated with music and allows a person to recollect past life events, and the associated emotions, when hearing certain songs or pieces of music.

However, it is worth noting that the spared functioning of musical memory and the associated emotions may be triggered as a result of the "Mozart effect" (Rauscher, Shaw, and Ky, 1993; 1995), which suggests short-term enhancement (10-15 minutes) in cognitive abilities after music listening. It has also been suggested that the Mozart effect may be a consequence of positive affect and heightened arousal, which could be induced by other enjoyable stimuli (Thompson, Schellenberg and Husain, 2001). Whilst musical memory is a remarkable human ability and can be temporarily stimulated in a therapeutic way, it may be of value to establish how it can be utilised to support persons in long term dementia care. In the context of long term dementia care, management of neuropsychiatric symptoms of dementia, such as agitation, depression, apathy and anxiety, is a major therapeutic task (Lawlor, 2002). Thus, how the exercise of musical memory can be dispersed into the day-to-day management of symptoms may be an area worth investigation.

### 1.1.2 Music therapy in dementia care

> *Mable arrives in her music therapy session in a restless mood, speaking loudly. She ambulates around the room whilst the music therapist sings Mable's favourite song to her. Once Mable has joined in singing "Holy, holy, holy…", the therapist repeats the song and each time transposes it down a key on the piano. The therapist also keeps slowing down and dampening the staccato beat. As this continues, Mable sings with less and less strength and volume. She eventually stops ambulating and comes to sing, standing by the therapist. After vocally harmonising Mable's end phrase "…blessed eternally", the therapist softens his voice and says to Mable, "That was beautiful!". Mable replies "Yes." with a breathy and quietened voice and looks fairly relaxed and calm. As Mable and the therapist step out from the session, a member of care home staff, with an exhilarating voice, asks Mable how she has enjoyed her session. Inevitably, Mable raises her voice in reply. Her mood appears to be elated again during this jollied-up conversation.*

The scenario above shows what a music therapy session might entail for a care home resident living with dementia. It also suggests how a trained music therapist might utilise a resident's abilities, such as singing in accord with the altered pitch and tempo, to modulate the resident's mood and behaviours. It further suggests how easily and quickly the therapeutic effects on the resident's mood and behaviour could diminish as a result of an interaction with a member of care staff after therapy. The scenario may reflect the findings of current literature, which indicates short-term effects of music therapy on neuropsychiatric symptoms (Brotons, Koger and Pickett-Cooper, 1997; Koger, Chapin and Brotons, 1999; Brotons, 2000; Vink et al., 2003, 2011; Ridder; 2005a; McDermott et al., 2012). The therapeutic effects have also been found to only exist during and immediately after therapy sessions (Livingston et al., 2005). Symptoms, such as agitation, are known to be common, persistent and distressing (Livingston et al., 2014) for individuals living with dementia. Therefore, the findings of these reviews may leave people wonder how music therapy can help in a long term care home setting, where residents need continuous support to manage their symptoms. In order to generate more evidence to support the use of music therapy in dementia care, there is a need for more randomised controlled trials, with longer intervention periods and better reporting quality (Vink et al., 2003; 2011; McDermott et al., 2012).

Apart from the short-term effects, flexible definitions of music therapy in current literature have also been a noted issue (McDermott et al., 2012). Some review studies (e.g., Douglas, James & Ballard, 2004; Wall and Duffy, 2010; Blackburn and Bradshaw, 2014) have referred to music therapy as either the music therapy described in the scenario above or music activities, which do not require qualified music therapists to deliver sessions. 'Music therapist' is a protected title in the UK for people who have completed the two-year music therapy master's training and registered with the Health and Care Professions Council (HCPC). The flexible definitions of music therapy used in these review studies put a question mark on the role of music therapists, and the requirement of music therapy training, in the field of dementia care. Accordingly, it raises questions surrounding what music therapy constitutes (i.e. "Can music therapy be music listening through headphones or a sing-along?") and the qualifications needed to run these sessions ("Can these activities only be led by a qualified music therapist?"). Arguably, some authors (Gold, 2009; Raglio, et al., 2010; Gold et al., 2011; Raglio, 2011) have suggested that the therapeutic relationship established between a therapist and client in therapy sessions is what distinguishes music therapy from music activities. This therapeutic relationship in music therapy is often underpinned by the psychodynamic theories that apply concepts, such as transference and countertransference (the unconscious mental attitudes based on important past relationships) (Freud, 1910; Jung, 1966), attachment (the emotional bond between an infant and primary caregiver that affects the child's behavioral and emotional development into adulthood) (Bowlby, 1969; Ainsworth, 1973) and object relations (infants form internal images of themselves in relation to others and these interal iamages are manifested in later interpersonal situations) (Klein, 1930; 1932; 1959; Fairbairn, 1963; Winnicott, 1960; 1971). These perspectives on relationship have been noted in music therapists' work across various clinical areas. For example, Winnicott's theories of providing emotional support in early childhood (Winnicott, 1960; 1971) and Stern's concept of affect attunement (Stern, 1985) were referred to in Oldfield's (2006a and 2006b) work in the field of child and family psychiatry. In the field of adult and old age psychiatry, Odell-Miller (1995; 1999) and Darnley-Smith (2002; 2004) also paid attention to psychoanalytic and psychodynamic theories when discussing the unconscious processes and the link between music and words within the interactive relationship in therapy. However, some psychodynamic theories and techniques can be more applicable than others, depending on clients' cognitive abilities. For example, transference and counter-transference can be utilised to explore past relationships through the therapist-client verbal exchange during therapy sessions. This verbal exchange involves clients' expressing feelings and thoughts by accessing their higher cognitive functions, such as memory, reasoning, thought and volition. Conversely, this may be impracticable with clients who have lost verbal communication and other higher functions due to severe dementia. However, transference and counter-transference may shed light on the interactions between therapist and client, for example how an older client unconsciously sees a younger therapist as a son, daughter or pupil. Therefore, it can be helpful to explore and understand this in the therapist's clinical supervision in order for the therapist to utilise this unconscious process in subsequent therapy sessions. Moreover, the concept of affect attunement (a shared affective state between a mother and infant that is attained through the mother using vocalisations, gestures and touching to match her infant's behaviours) (Stern, 1985; Stern et al.,1985) may still inform how a music therapist could interact with a client with severe dementia through nonverbal and musical exchange of expressions.

It is important to note that whilst the psychodynamics of relationship have been commonly considered in music therapy literature, it may not practically explain why and how music can be used to facilitate the therapeutic process. For instance, how the properties of music (e.g., pitch, duration, timbre) may be used to engage clients' cognition and modulate their behaviours and emotions. Explanations for such an enquiry may need to draw from other relevant disciplines, which can articulate the science of music and interpersonal communication. Further research would also be required to scientifically validate any theoretical notions. This would contribute to the understanding of the working mechanisms of music therapy and the role of music therapists in dementia care, which remain as a gap in the literature (McDermott et al., 2012).

### 1.1.3 The big picture in long term dementia care settings: quality of life and care

With the G8 Summit[3] in 2013 putting dementia as a global challenge into the spotlight, research needs are drastically raised. Finding a cure by 2025 is now a consensus for worldwide research. Whilst the search for a cure is on, there is also an urgent need to improve the quality of life and care for individuals living with dementia. Presently, there is little research exploring the relationship between quality of life and care. However, some factors have been noted to affect these two aspects of long term dementia care. Good quality of care has been indicated by factors such as absence of pain, pressure ulcers, malnutrition, physical restraint use and psychotropic medication (Organisation for Economic Co-operation and Development, 2005; Sixsmith, Hammon and Gibson, 2008). Quality of life can be impacted by factors such as dependence in activities of daily living (ADL), cognition, mood, depression and behavioural disturbances (Logsdon et al., 2002; Banerjee et al., 2006; 2009; Hoe et al., 2006; 2007; Wetzels et al., 2010). Although music therapy may not directly impact on all these factors, it might enhance symptom management, which might lead to lessened need for psychotropic medications. Despite previous research, which was carried out within this

[3] G8 Dementia Submit Communique, 2013. [online] Available at: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265868/2901669_G8_DementiaSummitCommunique_acc.pdf> [Accessed 05 May 2014].

respect (Svansdottir and Snaedal, 2006; Raglio et al., 2008; 2010a; 2010b; Guetin et al., 2009; Ridder et al., 2013), few studies have explored how music therapy interventions relate to quality of care and life. One study indicated the effects of individual music therapy on medications (Ridder et al., 2013); however, quality of life is a significant aspect for people living with dementia and reduced symptoms or improved cognition cannot be assumed as improved quality of life (Cooper et al., 2013). Therefore, it may be of value for music therapy research in dementia care to explain how research findings help improve patients' wellbeing (McDermott et al., 2012) and how different music therapy approaches contribute to patients' context of care (Guetin et al., 2012).

### 1.1.4 Motivation behind the research

As discussed above, greater clarity in the working mechanisms of music therapy in dementia care is a major target for research. However, what motivated the current study was not only this gap in knowledge but also an on-going challenge it had engendered in the author's day-to-day job. This was particularly manifested in explaining music therapy to carers, care home residents' families, the organisation's directors and in grant application, fundraising and marketing events. Without using a language, which people can relate to and some supporting evidence, it is hard to make a strong case for support. It could also fail to convince funders of why music therapy rather than sing-along activities or music listening on headphones should be prioritised for funding. Most importantly, it is crucial to explain what difference it can make on residents' health and care to have a music therapist working in care homes. However, the lack of an understanding of this difference is a problem at the present time.

In a care home environment, timely and practical methods or strategies are the key to meeting the needs of residents with dementia. A psychodynamic language, despite its usefulness in thinking of therapy and therapeutic relationship, might not provide an understanding of the brain and cognition, which is crucial for music therapists to address unmet needs due to a neuro-degenerative cause. Also, it might not allow music therapists to provide practical solutions to meet these needs in care home residents' everyday life. Therefore, theories based on an underlying neurological mechanism with scientific experimental evidence may make up the shortfalls of psychodynamic theories. The current study was motivated to find answers outside the 'music therapy' box by branching out into other theories based on neuropsychology and neuroscience. Research findings from these disciplines may provide new interpretations of music therapy. These may enable music therapists to explain how therapy sessions work through the lens of science and how their role makes a difference in dementia care services.

## 1.2 Research focus

The purpose of the current study was to explore whether and how individual music therapy might work to enhance the management of neuropsychiatric symptoms in a dementia care home setting. To suit this purpose, the current project addressed two aspects. The first aspect was the feasibility of using individual music therapy in care homes to reduce residents' symptoms during therapy sessions and to help care staff continue to manage symptoms after therapy in daily life. This aspect was explored by conducting a quantitative randomised controlled feasibility study, which also incorporated a qualitative strand using semi-structured interviews with the care staff. The second aspect was determining the mechanisms of how the therapist reduced residents' symptoms during therapy sessions. This was addressed through two mixed method case studies, which incorporated video analysis and heart rate measurements to report two trial participants' physiological and behavioural phenomena during their therapy sessions. These phenomena were interpreted within the framework of hermeneutic phenomenology to qualitatively indicate their meaning in relation with the two participants' health. By addressing these two aspects, the current study endeavoured to shed light on the working mechanisms of individual music therapy sessions and the role of music therapists in the context of long term dementia care. Therefore, it is envisaged that this study would justify the employment of qualified music therapists in care homes as well as provide a model that demonstrates how music therapy can be successfully implemented in dementia care homes.

## 1.3 Overview of the thesis

The ensuing chapters of the thesis are outlined as follows:

Chapter 2 presents an overview of the relevant literature, in order to establish whether and how neuropsychiatric symptoms of dementia might be managed in care homes with the use of music therapy. The chapter begins by addressing the clinical features of dementia and the management of neuropsychiatric symptoms as a major challenge in dementia care. This is followed by surveying the evidence of using psychosocial interventions, particularly music therapy and staff training, in symptom management. Later, the chapter draws upon the research findings from affective neuroscience to address the neurophysiological mechanisms of using musical, vocal, facial and bodily expressions in therapist-client interaction in music therapy. This then provides a foundation to discuss the emerging theory of emotion regulation, which forms a theoretical model of individual music therapy. The chapter concludes with a summary, which also formulates the music therapy intervention employed in the current study.

Chapter 3 describes the research methods used in the current study. The chapter starts with addressing the methodological considerations to provide reasoning for the use of a mixed methods approach throughout different phases of the study. This is followed by the research questions, study design and detailed procedure of data collection and analysis employed in the randomised controlled feasibility study and two single case studies.

Chapter 4 presents the results of the randomised controlled feasibility study, which include both quantitative and quantitative data. The quantitative results include care home residents' levels of symptoms and wellbeing while the qualitative results include staff perception of individual music therapy.

Chapter 5 and 6 present mixed methods case studies of Client A and Client B. Client A and B were both trial participants in the intervention group. Both chapters begin with the trial participant's background information. This is followed by the description of four music therapy sessions for each participant and the selected video excerpts from these sessions. The descriptions of the video excerpts detail a number of phenomena found within therapist-client interactions, which were manifested by changes in the participants' behaviours and heart rate as well as the therapist's behaviours. Both chapters conclude with a description of the post-therapy communication with care staff, which was part of the intervention in the feasibility study.

Chapter 7 presents the results of the analysis of the two participants' behaviours, heart rate and heart rate variability as part of the case studies. The chapter summarises the two trial participants' specific behaviours and reports the indices of heart rate and heart rate variability associated with these behaviours.

Chapter 8 presents the results of hermeneutic phenomenological analysis of the 16 selected video excerpts. The chapter provides an overview of the components observed within the therapist-client interactions.

Chapter 9 synthesises the results from the feasibility and case studies. The chapter discusses the findings with reference to previous research findings and the limitations of the current study. The chapter then concludes with recommendations for future research and clinical practice.

# Chapter 2 Literature review

## 2.1 Introduction

This chapter presents an overview of the relevant literature regarding dementia and music therapy. It begins with the definition and diagnostic features of dementia, which leads to a discussion of neuropsychological profiles and neuropsychiatric symptoms of dementia. This is followed by a survey of the evidence for the use of psychosocial interventions, particularly music therapy and staff training, in the management of neuropsychiatric symptoms. Later, the chapter draws upon the research findings from affective neuroscience to address the neurophysiological mechanisms of using musical, vocal, facial and bodily expressions in therapist-client interaction in music therapy. This provides a foundation to discuss the emerging theory of emotion regulation, which forms a theoretical model of individual music therapy. The chapter concludes with a summary, which conceptualises the music therapy intervention employed in the current study.

## 2.2 Search strategy

Prior to data collection in 2013, a literature review was undertaken to survey current evidence for music therapy as a treatment for neuropsychiatric symptoms of dementia. The literature search was carried out using the major electronic database search engines including AMED, CINAHL, EMBASE, Google Scholar, PsychINFO, PubMed and ScienceDirect. The search terms included (music or music therapy or dementia or music therapy and dementia) AND neuropsychiatric symptoms AND psychosocial interventions. Additionally, the terms dementia AND neuropsychology were used to provide an understanding of cognitive functions and testing in the field of dementia. The terms (psychophysiology or neuroscience) AND (emotion or music or facial expressions or vocal expressions or bodily expressions) were also used to obtain a conceptual understanding of the neural basis of the elements involved in music therapy treatment. The strength of the evidence was judged by the number of citations in other articles and reporting methods.

## 2.3 Dementia

### 2.3.1 Definition and diagnostic features

Dementia is a contemporary issue, affecting 46.8 million people globally. This figure will increase to 74.7 million in 2030 and 131.5 million in 2050[4]. As a result, there is an increased demand for long term care in which effective management of symptoms is a major issue. To put this in perspective, this figure 46.8 million is around 73% of the 64.1 million UK population (Office for National Statistics, 2013). In 2012, there were approximately 800,000 people living with dementia in the UK and 670,000 carers of these individuals (Alzheimer's Society, 2012). Dementia is mostly a condition of the elderly and it is a contributor to a looming health crisis. The £23 billion per year economic burden of dementia has outweighed those of cancer, heart disease and stroke. These costs will continue to rise to £35 billion by 2026 (The King's Fund, 2012). The burden of dementia is not only reflected through the financial aspects but also the years of life lost. Between 1990 and 2010, dementia leaped from 24th to 10th place in the top 25 causes of years of life lost in the UK (Horton, 2012). Furthermore, the growth of reported dementia cases results in a rising demand for long-term care. This is due to the cognitive impairments involved in dementia, which make a person become increasingly dependent on others to carry out daily living activities.

Such cognitive impairments are multi-domain and can be displayed by forgetfulness, language deterioration, mood changes, impaired judgement and loss of initiative (Mandell and Green, 2011). The 4th edition of the Diagnostic and Statistical Manual of

[4] Alzheimer's Disease International, 2015. *World Alzheimer Report 2015* [online] Available at: < https://www.alz.co.uk/research/WorldAlzheimerReport2015.pdf> [Accessed 06 February 2017].

Mental Disorders (DSM-IV) (American Psychiatric Association, 2000) specifies that impaired memory and an additional domain of cognitive impairments, such as aphasia, apraxia, agnosia or executive function, are required to meet the diagnostic criteria of dementia. The International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) (World Health Organisation, 2004), however, requires several domains to be affected. Dementia is, therefore, a syndrome that can be caused by many disorders, such as Alzheimer's Disease (AD), vascular dementia, dementia with Lewy bodies, frontotemporal dementia, Huntington's disease and Creutzfeld-Jakob disease. It is important to note that "the diagnosis of the type of dementia is made on clinical grounds and can only be verified by brain biopsy or at post-mortem" (Burton, 2010, p.149). This makes clinical assessments, which incorporate medical history, physical examination and behavioural and neuropsychological testing, vital in helping the identification of the type of dementia as well as tracking the stages of the disease. For example, in AD, the presence of biomarkers, including brain amyloid deposition and tau and beta-amyloid proteins, in cerebrospinal fluid precedes years before the presence of cognitive and behavioural symptoms. As the use of biomarkers to detect such a disease mainly applies to research, neuropsychological assessment is relied upon as symptom markers in clinical settings (Weintraub, Wicklund and Salmon, 2012). Cognitive symptoms are therefore assessed via the neuropsychological domains, which include memory, language, attention, executive functions and visuospatial abilities. Deficits in these domains are used to establish the profiles of different types of dementia.

### 2.3.2 Neuropsychological profiles of Alzheimer's and other types of dementia

#### 2.3.2.1 Episodic memory

Episodic memory (Tulving, 1972) is part of long-term and declarative memory which allows one to recall the particular times, places, associated emotions and contextual details of autobiographical events. Deficit in this type of memory is a marked feature of AD due to pathological changes in the medial temporal lobe, particularly the hippocampus. In laboratories, episodic memory can be tested by asking participants to encode and later retrieve lists of words, pictures and faces (Roediger and Marsh, 2003; Gilboa, 2004). Studies testing multi-sensory recognition, free recall and paired-learning have found that impaired episodic memory mainly results from ineffective consolidation and storage of new information, rather than ineffective retrieval of new information (Delis et al., 1991; Salmon, 2000). Accordingly, rapid forgetting is a major indicator of defective episodic memory and can be detected by assessing recall with a 10-minute delay using word list learning tasks (Welsh et al., 1991). Another indicator is defects in using semantic information to reinforce encoding (Martin et al. 1985; Dalla Barba and Wong 1995; Dalla Barba and Goldblum 1996). Moreover, impaired episodic memory can be indicated by increased sensitivity to interference. This is due to decreased inhibitory processes which lead to the production of intrusion errors (Fuld et al., 1982; Jacobs et al., 1990; Delis et al., 1991).

Some researchers (Roediger and Marsh, 2003; Gilboa, 2004) believe that caution should be taken to discuss episodic and autobiographical memory respectively rather than interchangeably.  The latter represents information related to personal history such as weddings, graduations and funerals. Accordingly, autobiographical memory is regarded as encompassing information from both episodic and semantic memory (the retrieval of general knowledge of facts, concepts, objects and the meanings of words). Therefore, this type of memory includes self-knowledge as well as the general knowledge that surrounds this self-knowledge (Roediger and Marsh, 2003). Remote autobiographical memories have been found to be better preserved than recent ones in patients with AD (Piolino et al., 2003). Compared with vascular dementia, caused by ischemic and haemorrhagic cerebrovascular disease or cardiovascular or circulatory disturbances that injure the brain (Román, 2005), episodic memory has been reported to be less impaired in patients with this type of dementia (Desmond et al., 1999; Graham et al., 2004; Reed et al., 2007). Patients with Dementia with Lewy Bodies, a condition marked by cell loss and the deposition of alph-synuclein protein (Lewy Bodies) in the subcortical brain regions that are also affected in Parkinson's disease (McKeith, 2002), show better retention and recognition memory. This suggests that defective retrieval plays a greater role in memory impairment than in that of patients with AD (Weintraub, Wicklund and Salmon, 2012, p.7).

#### 2.3.2.2 Language and semantic knowledge

Due to degeneration in the temporal, frontal and parietal association cortices, patients with AD display deteriorated structure and content of semantic memory, which supports language. As previously mentioned, semantic memory involves the retrieval of knowledge of objects, concepts and facts. Impairment in this type of memory is believed to disrupt the ability to associate objects and the relevant concepts (Hodges and Patterson, 1995). This impaired association is thought to be a result of the loss of semantic knowledge instead of impaired retrieval of such knowledge (Chertkow and Bub, 1990; Hodges et al. 1992; Rohrer et al., 1995; 1999). This can be tested by probing how the knowledge of a particular concept is accessed or manifested via verbal fluency test (the generation of semantic category lists), sorting, word-to-picture matching, etc. (Martin and Fedio,1983; Butters et al.,1987; Chertkow and Bub, 1990; Hodges et al. 1992; Monsch et al., 1992; Aronoff et al., 2006). For example, if a patient has lost the concept of "bus", they may not be able to generate "bus" on a verbal fluency test, match the word "bus" to a picture of a bus or sort bus into the category of "motor vehicle".

Patients with vascular dementia have been found to show greater impairment in semantic memory than patients with AD (Graham, Emery and Hodges, 2004). Deficits such as reduced speech output, verbal stereotypy (Pasquier , 1999; Snowden, Neary and Mann, 2002; Hou, Carlin and Miller, 2004) and impaired verbal fluency (Frisoni et al., 1995; Lindau et al., 1998; Mathuranath et al., 2000) are more pronounced in frontotemporal dementia, a group of degenerative dementias that are characterised by atrophy of the frontotemporal cortex (Hutchinson and Mathias, 2007). Language impairment appears to be a marked feature in distinguishing frontotemporal dementia from AD, as memory and visuospatial skills have been found to be less impaired in frontotemporal dementia (Elfgren et al., 1994; Frisoni et al., 1995; Mendez et al., 1996; Pachana et al. 1996; Lindau et al., 1998; Binetti et al., 2000; Thomas-Anterion et al., 2000).

#### 2.3.2.3 Executive functions

Executive functions encompass a broad range of abilities, such as verbal reasoning, problem-solving, sequencing, the ability to sustain attention, inhibition, utilisation of feedback, multitasking, cognitive flexibility and so on (Chan et al., 2008). Deficits in these abilities are found in patients with mild cognitive impairment (MCI) and in the early stages of dementia (Perry and Hodges 1999; Chen et al. 2001). Among these abilities, problem solving requiring mental manipulation of information has been found more impaired in patients with AD (Grady et al., 1988; Bondi et al., 1993; Lange et al., 1995; Waltz et al., 2004). Executive dysfunction is particularly linked to the degeneration of the prefrontal cortex (Johnson et al., 1999; Waltz et al., 2004), contributing to the disruption of neocortical networks (Weintraub, Wicklund and Salmon, 2012).

Working memory is another core component of executive functions. It refers to “a processing system whereby information that is the immediate focus of attention is temporarily held in a limited capacity, language- or visually-based, immediate memory buffer while being manipulated by a central executive” (Baddeley 2003 cited in

Weintraub, Wicklund and Salmon, 2012, p.4). Humming an unfamiliar melody which has just been played on the radio is an example of the use of working memory. The working memory system is believed to be relatively spared until later stages of AD (Baddeley et al., 1991; Collette et al., 1999). As working memory closely interacts with attention during the encoding and manipulation of information (Fougnie, 2008), studies have investigated some aspects of attention that are manifested in patients with AD. Divided attention (completing two or more simultaneous tasks) and selective attention (focusing on one of many simultaneous activities) appear to deteriorate earlier than focused and sustained attention in patients with AD (Parasuraman and Haxby, 1993; Perry and Hodges, 1999; Pignatti et al., 2006).

Due to white matter abnormality in Vascular Dementia, disruption between the frontal and subcortical networks may result in executive dysfunction which is the most prominent deficit in this type of dementia (Prince et al., 2005; Mathias and Burke, 2009). Furthermore, defective executive functions with more frequent variations in attention and alertness is more pronounced in dementia with Lewy Bodies than in AD at the same level of dementia severity (McKeith et al., 2005).

#### 2.3.2.4 Visuospatial abilities

Visuospatial abilities are related to aspects of attention such as overt and covert orienting (i.e. selectively attending to an object or location with or without eye movements) (Posner, 1980). Deficits in visuospatial skills have been found during the course of AD as well as in the preclinical stage (Cronin-Golomb and Amick, 2001; Johnson et al. 2009). Such deficits have been reported in studies which used tasks to test visuoperceptual abilities and visual orientation. In visual search tasks requiring patients with AD to quickly identify targets with two or more specific features (e.g., colour and shape or colour and motion), greater response times were observed relative to targets with a single or two similar features (e.g., colour and luminance) (Treisman 1996;

Foster et al. 1999; Festa et al., 2005). This has been attributed to ineffective integration between the cortical regions that process different sensory information (Morrison et al., 1991; Festa et al., 2005). Although impaired visuospatial skills are more prevalent in AD, it has been found to occur commonly and to a greater degree in mild vascular dementia (Graham, Emery and Hodges, 2004). Patients with Dementia with Lewy Bodies also display more pronounced visuospatial deficits. This is thought to be caused by the hypometabolism and decreased blood flow in the primary visual and visual association cortex found in this type of dementia (Minoshima et al., 2001). Visuospatial defect has also been linked to visual hallucinations, a marked symptom of Dementia with Lewy Bodies, which often identifies this type of dementia at autopsy (Tiraboschi et al., 2006).

Presently, there is no cure to stop or reverse the cognitive deterioration of the aforesaid conditions. However, these cognitive symptoms can be temporarily relieved by anti-dementia medications, including cholinesterase inhibitors (donepezil, rivastigmine and galantamine) and memantine. Cholinesterase inhibitors are prescribed for mild to moderate AD and memantine for moderate to severe AD (National Institute for Health and Clinical Excellence, 2011). These medications are also used to treat dementia with Lewy bodies. However, cholinesterase inhibitors have been found to be not effective for frontotemporal dementia and may cause agitation (O'Brien and Burns, 2011).

#### 2.3.2.5 Neuropsychological aspects in music therapy

Neuropsychological aspects of cognition may be highly relevant to music therapy. Such relevance can be manifested by the short-term effects of music on verbal fluency (Thompson et al., 2005), autobiographical recall (Foster and Valentine, 2001; Irish et al., 2006; Simmons-Stern, Budson and Ally, 2010), spatial-temporal reasoning abilities and immediate recall of words (Cacciafesta et al., 2010). These temporarily enhanced cognitive skills may result from the influence of music on arousal and mood

(Schellenberg, 2005; Särkämö, et al., 2012). In music therapy sessions, the combined use of attention, memory and sensorimotor integration may be observed during patients' foot tapping to music or motor coordination whilst playing instruments. Although accessing these cognitive abilities is limited by the degree of degeneration of specific cortical regions, observed musical engagements may indicate remaining functions. Odell-Miller's (2002) observation of patient M, who displayed deficits in visuospatial memory due to the right parietal lobe degeneration, provided an example of the above notion. In his earlier music therapy sessions, M was able to improvise on the piano and return to a musical phrase or section of music used at the beginning of a piece (p. 153). This may indicate his less impaired musical short-term memory, which could also link to the musical semantic memory, demonstrated by his ability to recognise musical keys and moods. Observing these accessible residual functions may help infer the neural connectivity between brain regions. More importantly, such observations over the course of music therapy treatment may help monitor deterioration over time. This may, in turn, inform the decision making in adjustments made to care planning and delivery. For example, the discontinuation of memantine has been reported to be associated with declining health status, particularly worsening cognition and mood for nursing home residents with AD. The decision to terminate this medication could be motivated by budgetary concerns or the lack of perceived continuing medical benefits (Fillit et al., 2010). Therefore, feeding back music therapists' observations of residents' cognitive abilities in therapy sessions may prevent overlooking the continuing effects of medications and contribute to better decision making.

### 2.3.3 Neuropsychiatric symptoms of dementia

In addition to managing the difficulties caused by cognitive decline, a major challenge in dementia care is managing a group of associated non-cognitive symptoms known as Neuropsychiatric Symptoms (NPS) of Dementia (Cummings et al., 1994; Craig et al., 2005; Aalten 2005a; 2005b; Lyketsos, 2007). Agitation, apathy, aberrant motor behaviour, psychosis and mood and emotional disorders, including depression and anxiety all contribute to the constellation of the neuropsychiatric symptoms. The prevalence of these symptoms is high in nursing homes; up to over 90% of this population has been reported to be affected by NPS (Wagner, Teri and Orr-Rainey, 1995; Brodaty et al., 2001; Margallo-Lana et al., 2001; Selbæk, Kirkevold and Engedal, 2007; Zuidema et al., 2007; Lyketsos et al., 2011). This prevalence may be linked to the severity of dementia within nursing home admission (Steele et al., 1990). In community dwelling patients, more persistent occurrence has been observed for apathy and aberrant motor behaviour, such as excessive pacing, wandering and repetitive vocalisation (Aalten et al. 2005a). In nursing homes, agitation is the most persistent and prevalent symptom although depression and anxiety decrease over time whilst apathy tends to increase (Wetzels et al., 2010). The symptoms are associated with faster progression of the disease if untreated (Rabins et al. 2013). It is worth noting that depression, anxiety and agitation have been reported as the factors influencing the quality of life of residents in dementia care homes (Beerens et al., 2013). Whilst there is an emphasis on the role of neurochemical, neuropathological and genetic factors underlying clinical presentations, the pathogenesis of these symptoms has been understood as derived from a complex interplay of psychological, social and biological factors (Cerejeira, Lagarto and Mukaetova-Ladinska 2012). Accordingly, attention has been drawn to understanding the causes of such symptoms as well as identifying preventive and coping strategies. Many current approaches in dementia care regard behaviours as a reflection of underlying unmet psychosocial needs (Cohen-Mansfield and Werner, 1995; Cohen-Mansfield, 2001; Douglas, James and Ballard, 2004) and an attempt to communicate such needs (Kitwood, 1997a). For instance, Verbal Disruptive Behaviour (VDB) is a symptom encompassing repetitive and inappropriate abusive language, screaming and moaning, which causes disruption and distress to others in the nursing home (Cohen-Mansfield and Werner, 1997; McMinn and Draper, 2005). Apart from neurological change, such a symptom can be theoretically understood as an expression of discomfort (e.g., pain and depression) or sensory deprivation or social isolation (e.g., fear, loneliness, boredom or a lack of structured activities and interactions) (Cohen-Mansfield and Werner, 1997). Kitwood's work in particular has placed importance on the quality of relationships between people with dementia and their caregivers as key to well-being (Kitwood and Bredin, 1992). His concept of 'person-centred care' initiated a shift away from the more medical approach and emphasised the importance of considering the individual and their unique psychosocial needs.

Psychotropic medications, such as risperidone, quetiapine olanzapine and benzodiazepines have been prescribed to ameliorate neuropsychiatric symptoms. However, reviews indicate no or moderate effects on symptoms (Bains, Birks and Dening, 2002; Lonergan et al., 2002; Sink, Holden and Yaffe, 2005) and no effect on quality of life (Cooper et al. 2012). Additionally, there has recently been growing concern regarding the over-use and risk of such medications (Prudent et al., 2008; Gustafsson et al., 2013). Falls and fractures as a result of sedation as well as stroke and death have been associated with such medications (Leipzig, Cumming and Tinetti, 1999; Schneider, Dagerman and Insel, 2005; Kales et al., 2007; Prudent et al., 2008). The National Dementia Strategy (DoH, 2009) has prompted the reduction of medication nationwide within UK care settings and highlights the importance of non-pharmacological interventions. A report commissioned by the Department of Health (Banerjee, 2009) emphasised a need for further research investigating the clinical and cost effectiveness of non-pharmacological methods.

## 2.4 Psychosocial interventions

Increasing research has been carried out to investigate the effectiveness of non-pharmacological interventions, often referred to as psychosocial interventions (Cohen-Mansfield, 2004; Vernooij-Dassen et al., 2010; Tampi et al., 2011b; Lawrence et al., 2012; Orrell, 2012). These non-drug methods include an array of sensory, psychological and behavioural interventions such as staff education, behavioural management techniques, pet therapy, aromatherapy, snoezelen, cognitive stimulation therapy, music therapy, etc. These interventions have been recommended as first-line treatment for NPS, before considering psychotropic medications (Howard et al., 2001). Growing evidence suggests the positive impact of psychosocial interventions on neuropsychiatric symptoms, cognition and quality of life (Spector et al. 2003; Livingston et al., 2005; Teri, McKenzie and LaFazia, 2005; Vasse et al. 2012). More importantly, these interventions can contribute to an increased understanding of the interplay between psychosocial factors and the presentation of NPS. Gitlin, Kales and Lyketsos (2012) described this interplay between psychosocial factors and NPS: “Nonpharmacologic approaches conceptualize behavioural symptoms as expressions of unmet needs (e.g., repetitive vocalizations for auditory stimulation); inadvertently reinforced behaviour in response to environmental triggers (e.g., patient learns screaming attracts increased attention); and/or consequences of a mismatch between the environment and patients' abilities to process and act upon cues, expectations and demands” (p.5). Accordingly, non-pharmacological treatments may provide insights into contributing psychosocial factors of symptoms. For example, why apathy arises from lack of stimulation or agitation is triggered by a noisy environment or unseemly carer-patient interaction. Treatment details may incorporate the analysis and modification of the causal relationship between factors, such as cognitions, environments and behaviours. This makes preventing and reducing patients’ symptoms as well as caregiver distress the ultimate goal of psychosocial interventions (Gitlin, Kales and Lyketsos 2012).

### 2.4.1 Staff training

Training staff in caring for dementia patients and managing behaviour is a critical aspect of care in all nursing homes (Rabins, Lyketsos and Steele, 2006, p.87). It is not surprising that attention has been paid to staff training as an important psychosocial intervention (Cohen-Mansfield, 2001; Aylward et al., 2003; Livingston et al., 2005; Kuske et al., 2007; Spector, Orrell and Goyder, 2013). Generally, most of the training focuses on improving care staffs’ verbal and nonverbal communication with patients (Cohen-Mansfield, 2001). Particularly, psychoeducation and teaching carers to change their way of interacting with patients have been reported to show consistent evidence of effectiveness and lasting effects (Livingston et al., 2005). A study by Cohen-Mansfield et al. (2010) supports this by highlighting that live one-to-one interaction based on self-identity is the most beneficial stimuli to engage patients with dementia. Additionally, the authors suggested that staff should be trained to maximise such socialisation during daily living activities such as dressing, bathing, and feeding. Many methods to deliver staff training have been explored. These include lectures, discussions, videotaped depictions, role-playing, experiential exercises, active learning techniques, brainstorming, workbooks, written or real-life vignettes and feedback or a mixture of these (Kuske et al., 2007). Spector, Orrell and Goyder (2013) suggested that a change in staff behaviour could impact on residents’ symptoms. Once changes to care practices were made, the positive effects could usually be maintained over time. However, the changes appear to rely on transferring learned theory into practice and sustaining this transfer over time (Aylward et al., 2003; Kuske et al., 2007). The need for a supervision system has been suggested to prevent staff from reverting back to previous styles of care practice (Spector, Orrell and Goyder, 2013). These findings all emphasise the need of repeated ongoing training (Cohen-Mansfield, 2001). Additionally, organisational support also plays a vital role in helping maintain changes made in staff behaviour (Kuske et al., 2007). Such support can include modifying policy and treatment guidelines as well as adjusting staff work schedules to enable practice opportunities (Aylward et al., 2003; Lawrence et al., 2012). Other factors such as management style, care culture and rifts between staff groups should also be considered within this respect (Spector, Orrell and Goyder, 2013, p.363).

All in all, these findings corroborate that caregiver strategies and characteristics are central to the management of symptoms (de Vugt et al., 2004; Sink et al., 2006). Providing staff with sufficient skills and support is fundamental to manage symptoms and ensure the safety and quality of life of people with dementia (Banerjee, 2009). This may explain why active staff involvement is the key to successfully implementing psychosocial interventions in care homes (Lawrence et al., 2012). Moreover, as care staff are most frequently in contact with care home residents, staff involvement may enable the embedding of psychosocial interventions into daily care (Vernooij-Dassen et al., 2010). The provision of psychosocial interventions, including music therapy, may merit from incorporating the above insights and aim to enhancing staff knowledge and skills on a regular basis. Therefore, such interventions may not be perceived as standalone or dispensable, but an integral part of the care. After all, concerted multi-disciplinary team input is central to pharmacological and non-pharmacological treatments as well as carer-focused training and education to decrease neuropsychiatric symptoms of dementia (Lawlor, 2002).

## 2.5 Music therapy in dementia care

### 2.5.1 An overview of music activity and music therapy for neuropsychiatric symptoms

Music therapists are recognised as healthcare professionals around the globe. In countries such as Australia, New Zealand, Japan, the United States and several European nations, music therapists are regulated by their respective healthcare regulatory bodies. In the UK, music therapists, alongside other professionals including physiotherapists and practitioner psychologists, constitute the Allied Health Professionals regulated by the Health and Care Professions Council (HCPC). This means that in order to use the protected title of 'music therapist' to practice in the UK, one must complete the two-year Master's level training qualification and obtain a state registration with HCPC (HCPC, 2014). However, the term 'music therapy' in current literature, particularly in the field of dementia care, is often used flexibly to refer to either a formal therapy led by qualified therapists or music-based interventions led by other healthcare professionals, researchers or musicians. The following sections will discuss the issues around this flexible definition of music therapy. For the ease of reading, 'music therapy' and 'music activity' will be used respectively to refer to a qualified music therapist-led intervention and all other staff or musician-led music-based interventions.

Music activity often involves patients singing known songs, playing instruments or listening to pre-recorded music (Lord and Garner, 1993; Ragneskog et al., 1996; Denney, 1997; Clark, Lipe and Bilbrey, 1998; Gerdner, 2000; Remington, 2002; Sung et al., 2006). It is arguably different from the nature of music therapy, which focuses on building a therapeutic relationship between the therapist and client. Therapist-client interaction, involving freely joint live music making as well as verbal and nonverbal communication, forms the basis of this relationship (Odell-Miller, 1995; Ridder and

Aldridge, 2005; Raglio et al., 2008; 2010; Ridder, Wigram and Otessen, 2009). Despite a dichotomy between their respective natures, music therapy and music activity share the same tool – music. Both interventions make use of music via singing, listening or instrument playing. Studies of music activity such as Clark, Lipe and Bilbrey (1998) have also been conducted by music therapists. This may explain why flexible boundaries between the two interventions exist in current literature. It is worth noting that such obscurity may hinder tailored care in care homes, as the indistinctive methods and purposes between music activity and music therapy may suggest "one treatment suits all". Understandably, residents may respond to certain interventions better than others due to individual characteristics and preferences (Cooke et al., 2010a; 2010b). Without considering all these relevant factors, residents' needs might not be met due to a chosen intervention that is not fit for purpose. Whether prescribing a dose of song singing in music activity is more beneficial than building a therapeutic relationship in music therapy may depend on a resident's specific needs. The same logic may apply in choosing either physical exercises or physiotherapy. Prescribing solely physical exercises instead of having a physiotherapist carry out assessments and treatments for a particular condition may have a detrimental effect on one's health. Therefore, a qualified therapist who has undergone training to meet the standards of proficiency in delivering treatment and advice may have a place in identifying an appropriate intervention. Music therapy and music activity interventions may deserve a more distinctive definition and identify.

Looking at the current evidence, most reviews of non-pharmacological interventions, music-based interventions and music therapy have made no differentiation between music activity and music therapy (Cohen-Mansfield, 2001; Douglas, James and Ballard, 2004; Sherratt, Thornton and Hatton, 2004; Livingston et al., 2005; Sung and Chang, 2005; Hulme et al., 2009; O'Connor et al., 2009a; 2009b; Wall and Duffy, 2010; Guetin et al., 2012; Ueda et al., 2013). Table 2.1 outlines 26 review studies, which were published between 1997 and 2013. Three types of reviews were identified among these review studies:

1. Systematic review: reviews that aim to answer a specific research question by examining all empirical evidence that fits pre-defined eligibility criteria. Systematic reviews often include a meta-analysis, which is “the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating findings” (Glass, 1976, p.3).
2. Integrative review: reviews that provide the synthesis of both quantitative and qualitative studies to establish a more comprehensive understanding of a particular health problem. Integrative reviews have the potential to contribute to theory development and have direct applicability to practice and policy (Whittemore and Knafl, 2005).
3. Literature review: reviews that use a descriptive and qualitative approach to summarise relevant literature about a subject. Methodology of the literature search and selection is not always specified (Cook, Mulrow and Haynes, 1997).

Most of the 26 reviews have included both music therapy (MT) and music activity studies (MA). 12 out of these 26 reviews examined more broadly all the non-pharmacological interventions (e.g., Opie, Rosewarne and O'Connor, 1999; Cohen-Mansfield, 2001; Livingston et al., 2005; O'Connor et al., 2009a; 2009b; Kverno et al., 2009; Kong, Evans and Guevans; 2009; Hulme et al., 2010; Vernooij-Dassen et al., 2010; Olazaran et al., 2010; Seitz et al., 2012; Brodaty and Burns, 2012); these generally employed a systematic review approach and included a small number of music therapy or music activity studies. The 26 reviews have provided some repeated themes as insights into music-based interventions. For example, methodological and reporting weakness of the included music-based intervention studies were reported by 6 reviews (Sherratt, Thornton, and Hatton, 2004; Olazaran et al., 2010; Vink, Bruinsma and Scholton, 2011; McDermott et al., 2012; Brodaty and Burns, 2012; Vasionyte and Madison, 2013). Short-term effect on neuropsychiatric symptoms was noted by 8 reviews (Livingston et al., 2005; Kverno et al., 2009; Wall and Duffy, 2010; Seitz et al., 2012; McDermott et al., 2012; Brodaty and Burns, 2012; Ueda et al., 2013; Särkämö et al., 2013). The effectiveness of individualised music rather than generic relaxation music was also highlighted by 4 studies (Douglas, James and Ballard, 2004; O'Connor et al., 2009b; Kverno et al., 2009; Wall and Duffy, 2010).

Moreover, some mixed results were noted regarding how music was more effectively used, i.e., music administered by a trained therapist vs. other professionals and live interactive music vs. pre-recorded music (Koger, Chapin, and Brotons, 1999; Kverno et al., 2009; Vasionyte and Madison, 2013). It is also interesting to note that singing (McDermott et al., 2012), therapist-client interaction (Raglio et al., 2012) and an individually tailored approach (Vernooij-Dassen et al., 2010; Brodaty and Burns, 2012) were suggested to be significant features of effective non-pharmacological interventions.

Regardless of the types of interventions, these reviews generally posit that music activity and music therapy can potentially alleviate neuropsychiatric symptoms, which pose the major challenge in dementia care (see Table 2.1). However, upon a closer examination, inconsistency and ambiguity can be found in the definitions of the interventions as well as inclusion criteria in some of these reviews. These common issues can to some extent influence the findings.

A Cochrane review by Vink, Bruinsma and Scholten (2011) cites the World Federation of Music Therapy's (WFMT) definition of music therapy:

> “…as the use of music and/or its musical elements (sound, rhythm, melody and harmony) by a qualified music therapist, with a client or group, in a process designed to facilitate and promote communication, relationships, learning, mobilisation, expression, organisation and other relevant therapeutic objectives in order to meet physical, emotional, mental, social and cognitive needs” (WFMT, 2010 cited by Vink, Bruinsma and Scholten, 2011, p.2).

However, studies such as Gerdner (2000) and Sung et al. (2006) in the 10 reviewed studies did not define their interventions as music therapy. The interventions were respectively group sessions incorporating music and movement and individualised music listening which were delivered by nursing and research staff. This review focused on the parallel and crossover randomised controlled studies but drew no useful conclusions due to the poor methodological quality of the included studies.

Table 2.1 Review studies of psychosocial interventions, music activity and music therapy (MT= music therapy. MA= music activity. NS= not specified.)

| **Title** | **Author(s)** | **Year** | **Journal** | **Type of Review** | **Total No. of Studies** | **No. of MT studies** | **No. of MA studies** | **Findings** |
|---|---|---|---|---|---|---|---|---|
| Music, Emotion, and Dementia: Insight From Neuroscientific and Clinical Research | Särkämö et al. | 2013 | Music and Medicine | Integrative | NS | NS | NS | Both music therapy and caregiver-implemented music activities may reduce emotional and behavioural disturbances. Long-term effects are elusive. Potential role for everyday music activities at the early stages of dementia. |
| Effects of music therapy on behavioural and psychological symptoms of dementia: A systematic review and meta-analysis | Ueda et al. | 2013 | Ageing research reviews | Systematic, meta-analysis | 20 | 11 | 9 | Moderate effects on anxiety and small effects on behavioural symptoms. In studies of duration >3 months, music therapy had large effects on anxiety. The effects of music therapy were greater than those of other non-pharmacological interventions. Music therapy is recommended before pharmacological intervention. |
| Musical intervention for patients with dementia: a meta-analysis | Vasionyte and Madison | 2013 | Journal of clinical nursing | Meta-analysis | 19 | 7 | 12 | Large positive effects on behaviour, cognition and physiology and medium effects on affect. The included studies have poor methodological quality which limits the reach of meta-analysis. Listening to classical music rather than live active music therapy has higher positive outcome. Therapist-selected rather than personally preferred music administered in a group is potentially more effective. |
| Non-pharmacological management of apathy in dementia: A systematic review | Brodaty and Burns | 2012 | The American Journal of Geriatric Psychiatry | Systematic | 56 | 5 | 6 | Therapeutic activities, particularly those provided individually, have the best available evidence for effectiveness for apathy in dementia. All but one of the 11 music studies show positive results; however, no RCTs are included. Low quality in research for music interventions. Little evidence of sustainability of effect once the intervention ceases. |
| Managing behavioural symptoms in dementia using nonpharmacologic approaches: an overview | Giltin, Kales and Lyketsos | 2012 | Journal of the American Medical Directors Association | Integrative | NS | NS | NS | Music interventions, ranging from recorded music to music activities, in individual or group settings are promising. Increased agitation and physical aggression has been reported for some sensory approaches including music therapy. Careful monitoring of behavioural improvement or worsening, with particular attention to heightened agitation, is necessary. |
| An overview of the use of music therapy in the context of Alzheimer's disease: A report of a French expert group | Guetin et al. | 2012 | Dementia | Integrative | NS | NS | NS | Music therapy supports patients with Alzheimer's disease who have cognitive, emotional and behavioural disorders. |
| Music therapy in dementia: a narrative synthesis systematic review | McDermott et al. | 2012 | International Journal of Geriatric Psychiatry | Systematic | 18 | 18 | 0 | Evidence for short-term improvement in mood and reduction in behavioural disturbance. No high-quality longitudinal studies that demonstrated long-term benefits of music therapy. Singing appeared to be associated with benefits in both quantitative and qualitative studies. No studies investigated how and why music therapy may work. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Music, music therapy and dementia: A review of the literature and the recommendations of the Italian Psychogeriatric Association | Raglio et al. | 2012 | Maturitas | Integrative | 32 | NS | NS | Evidence for cognitive and physiological aspects is scant. Consistent efficacy of MT approach on BPSD. The ability of the music therapist to directly interact with the patients appears to be crucial for the success of the intervention. The use of individualised music listening based on preferred and/or familiar music as background music did not prove its efficacy. |
| Efficacy and feasibility of nonpharmacological interventions for neuropsychiatric symptoms of dementia in long-term care: a systematic review | Seitz et al. | 2012 | Journal of the American Medical Directors Association | Systematic | 40 | 2 | 1 | Some support for interventions involving music and sensory stimulation. Psychosocial activities are generally short-term and probably most effective in reducing NPS while participants are actively engaged in the intervention. |
| Music therapy for people with dementia (First published in 2003 and updated in 2011 ) | Vink, Bruinsma and Scholton | 2011 | Cochrane Database of Systematic Reviews | Systematic | 10 | 6 | 4 | Studies generally have poor reporting quality. No substantial evidence to support or discourage the use of music therapy. |
| Non-pharmacological therapies in Alzheimer's Disease: A systematic review of efficacy | Olazaran et al. | 2010 | Dementia and Geriatric Cognitive Disorders | Systematic | 179 | 7 | 2 | Use of music was not recommended as a non-pharmacological intervention due to lack of efficacy. Problems may have included lack of studies, lack of adequate measures, poor design and insufficient duration of intervention. |
| Psychosocial interventions for dementia patients in long-term care | Vernooij-Dassen et al. | 2010 | International psychogeriatrics | Systematic | 28 | 1 | 0 | Music therapy is a promising intervention to reduce symptoms. The most promising interventions appear to be those that are individually tailored and behaviour-oriented. |
| The effects of music therapy for older people with dementia | Wall and Duffy | 2010 | British Journal of Nursing | Systematic | 13 | NS | NS | Short-term effects on the behaviour of older people with dementia, with live, individualised music being the most beneficial. Levels of agitation were reduced, including verbally aggressive and non-physically aggressive behaviour. Music therapy also promotes positive effects in mood and socialisation. These positive effects also extend to caregivers. |
| Non-pharmacological approaches for dementia that informal carers might try or access: a systematic review | Hulme et al. | 2010 | International Journal of Geriatric Psychiatry | Systematic | 33 | 2 | 8 | There is evidence of music/music therapy in reducing agitation, aggression, wandering, restlessness, irritability, social and emotional difficulties, and improving nutritional intake. |
| Non-pharmacological intervention for agitation in dementa: a systematic review and meta-analysis | Kong, Evans and Guevans | 2009 | Aging and Mental Health | Systematic | 14 | 0 | 1 | Only sensory interventions (aromatherapy, thermal bath, and calming music and hand massage) had efficacy in reducing agitation. The review included one music intervention study, which used music during hand massage. |

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| Research on treating neuropsychiatric symptoms of advanced dementia with non-pharmacological strategies, 1998-2008: a systematic literature review | Kverno et al. | 2009 | International psychogeriatrics | Systematic | 215 | 1 | 2 | All three music studies reported significant reductions in symptoms. Agitated behaviours were reduced to a greater extent with live or pre-recorded preferred music than usual care. Lasting benefits of music/music therapy were found to be present at 15 minutes but not at four weeks post-treatment. Limited but good quality evidence supporting the use of music/music therapy for the short-term reduction of agitation and apathy. Interactive live music and preferred music appear to be more beneficial than pre-recorded music for individuals with advanced dementia. |
| Psychosocial treatments of psychological symptoms in dementia: a systematic review of reports meeting quality standards | O'Connor et al. | 2009a | International psychogeriatrics | Systematic | 12 | 0 | 1 | Interventions with moderate effect sizes included music and recreation therapy. A study looking at music during mealtimes in dementia care found that irritability, fear and depression decreased and more food was served during the music condition compared to 'usual mealtimes'. |
| Psychosocial treatments of behavior symptoms in dementia: a systematic review of reports meeting quality standards | O'Connor et al. | 2009b | International psychogeriatrics | Systematic | 25 | 2 | 6 | Music proved very effective in five out of eight studies. Agitated behaviours responded better to individually tailored music than 'classical relaxation music' and aggression declined significantly when participants' preferred music was played during bath times. 'Off the shelf' music, by contrast, worked no better than hand massage, book readings, or mealtimes without music. |
| Neuropsychiatric symptoms of dementia: importance and treatment considerations | Ballard et al. | 2008 | International Review of Psychiatry | Literature | NS | NS | NS | In small crossover and placebo controlled studies a number of approaches such as music and simulated presence therapy reduce the severity of behavioural symptoms by about 25%. Larger trials for agitation demonstrate that structured interaction, music and simulated presence therapy were all significantly more beneficial than placebo. |
| Systematic review of psychological approaches to the management of neuropsychiatric symptoms of dementia | Livingston et al. | 2005 | the American Journal of Psychiatry | Systematic | 162 | 9 | 15 | Evidence of short-term effects of music therapy on decreasing agitation during sessions and immediately after intervention. No evidence of long-term effect. |
| Non-pharmacological interventions in dementia | Douglas, James and Ballard | 2004 | Advances in Psychiatric Treatment | Integrative | NS | NS | NS | Several studies have reported benefits gained by people with dementia from music therapy. One study found increased social interaction, well-being, and improved autobiographical memory. These effects were not found in a comparison group. Studies have also found MT significantly decreased abnormal vocalisations and another found reduced agitation for those played individualised music vs. generic relaxation music. |

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| Music interventions for people with dementia: A review of the lieterature | Sherratt, Thornton, and Hatton | 2004 | Aging and Mental Health | Systematic | 21 | 8 | 13 | Methodological weaknesses were found in music studies. Most studies reported the effects of music to be effective in decreasing aggression, agitation, wandering, repetitive vocalisations, and irritability. Music was also found to increase reality orientation, memory recall, time spent with one's meal, levels of engagement and participation, and social behaviour. |
| Nonpharmacologic interventions for inappropriate behaviours in dementia | Cohen-Mansfield | 2001 | The American Journal of Geriatric Psychiatry | Systematic | 83 | 1 | 10 | Music interventions were used for two general purposes: as a relaxation during meals or bathing, or to provide sensory stimulation. Decreases in aggression were during bathing and mealtimes. Reduction in agitation/verbal agitation was found during music listening. One music therapy study found a significant decrease in agitation. |
| Is music therapy an effective intervention for dementia? A meta-analytic review of literature | Koger, Chapin, and Brotons, | 1999 | Journal of Music Therapy | Meta-analysis | 21 | 9 | 12 | Effect of music/music therapy was found to be highly significant, but effect sizes were inconsistent across studies. No specific variables were found to influence effectiveness, ie. type of therapeutic intervention (passive vs. active), music (live or taped), therapist's training (trained therapist vs. other professional), dependent variable (behavioral, cognitive or social), or length of treatment. |
| The efficacy of psychosocial approaches to behaviour disorders in dementia: A systematic literature review | Opie, Rosewarne and O'Connor | 1999 | Austrailian and New Zealand Journal of Psychiatry | Systematic | 43 | 0 | 10 | All ten studies utilising music interventions reported positive findings. |
| Music and dementias: A review of literature | Brotons, Koger and Pickett-Cooper | 1997 | Journal of Music Therapy | Literature | 69 | NS | NS | Music/music therapy is an effective intervention to maintain and improve active involvement, social, emotional and cognitive skills, and to decrease behaviour problems of individuals with dementia. |

Table 2.1 continued

Wall and Duffy (2010) reviewed the effects of music therapy for older people with dementia. They concluded that music therapy had a positive influence on agitated behaviour, mood and social skills and the effect could extend to carers. This review specified 'music therapy' as the search term and referred to the definition by the American Music Therapy Association (AMTA) (AMTA, 2005 cited in Wall and Duffy, 2010). However, there was no clarity regarding the inclusion and exclusion criteria. The 13 reviewed studies included studies such as Garland et al. (2007) and Hicks-Moore and Robinson (2008), which investigated the effects of preferred music rather than music therapy. These studies did not appear to involve music therapists in the design or delivery of the interventions.

Raglio et al. (2012) reviewed 32 randomised controlled trials and clinical controlled trials of both music activity and music therapy. They found that the music therapist's ability to directly interact with the patients appeared to be crucial in managing behavioural and psychological symptoms of dementia. The authors took an overarching approach to include studies of music activity and music therapy. They, however, acknowledged that music therapy was frequently assimilated to music activity including music-making and music-listening. For this, they made a further clarification:

> "The authors are here referring to a definition of MT implying the essentially relational nature of the intervention, which should be grounded upon theory–practice coherence and adequately verifiable. A MT intervention should take place in a therapeutic setting, and be conducted by adequately trained music therapists. The aims (tending towards stability and duration in time, according to the pathology's degree of severity) should be well aimed both at symptoms with their complications, and at the modifications in intrapsychic and interpersonal dynamics." (Raglio et al., 2012, p.306)

This review stressed the importance of therapist-patient interaction and therapeutic aims in therapy rather than the delivery of musical activities. The Italian Psychogeriatric Association endorsed this view and recommended music therapy as a preferred treatment, particularly for moderate to severe dementia, to meet patients' tailored needs and improve behavioural and psychological symptoms and communicative skills. The authors further suggested that future research should compare the effects of music therapy and music activity.

Comparing group music therapy with recreational activities, Vink et al. (2013) in their trial (n=77) found no additional benefits of group music therapy to reduce agitation. However, they noted music therapists' anecdotal accounts of patients' increased social interaction and enjoyment due to music therapy but few outcome measures were designed to measure these. This indicates that patients' positive behaviours may be momentary during the therapist-client interaction in therapy sessions. Therefore, capturing these moments of positive behaviours in line with the quality of therapist-client interaction may be key to suggesting the effect of music therapy. This also means that the temporal dynamics of therapist-client interaction, particularly one-to-one interaction within sessions, may deserve more in-depth quantitative as well as qualitative explorations. The need for qualitative work to be included in RCT studies of psychosocial interventions has been suggested to help understand how interventions work (Orrell, 2012).

McDermott et al. (2013) conducted a narrative synthesis systematic review of music therapy in dementia care (n=18), which focused not only on what worked but also why and how an intervention might have worked. Despite an agreement in short-term improvement of mood and behavioural disturbance (Livingston et al., 2005; Vink, Bruinsma and Sholten, 2011), the authors found no discussion of why and how music therapy might have worked to improve the wellbeing of people with dementia. This review underlines a need for researching a theoretical model and the underlying mechanisms of music therapy. This may further help discern the nature of music therapy and music activity and indicate the role of music therapists.

Having reviewed 400 studies investigating the neurochemical effects of music, Chanda and Levitin (2013) echoed the need for drawing a line between music intervention and music therapy:

> "We note that – in most studies – the methods used did not qualify as Music Therapy, in that music intervention was not administered to participants by a licensed therapist. Instead, music intervention was administered to the participants by the experimenter or another type of health care professional (e.g., nurse). It remains to be investigated whether music administered in the context of a music therapy session is more effective than music interventions administered by other types of healthcare practitioners or by the patients themselves. Future studies would benefit from the inclusion of music therapists as consultants or active members of research teams, because their perspective on the application of music in clinical settings may be informative." (Chanda and Levitin, p.189)

This sums up the aforementioned obscurity between music activity and music therapy in current literature. Whilst future research is warranted to discern their effects, the authors also suggested an important role of music therapists to be included in clinical settings and research. This role might not be limited in delivering music therapy, as music therapists' knowledge may go beyond the therapy rooms to enhance day-to-day life. Särkämö et al. (2012) noted the potential benefits of everyday carer-implemented musical activities such as music listening and singing for the wellbeing of people with dementia. They suggested that the use of music from music therapy can be expanded into a more everyday context in dementia care by providing music-related training to carers.

The reviews to date have highlighted a consensus on the short-term effects of music therapy and music activity on neuropsychiatric symptoms and the need for longitudinal RCTs to explore long-term effects. Flexible definition of music therapy and music activity has been a prominent feature in the reviews. However, different emphases have been noted during the process of delivering the respective interventions. Music activity tends to focus on delivering musical stimuli to patients by instructing patients to participate in song singing, instrument playing or music listening. Conversely, music therapy centres on the therapist-patient interaction where the exchange of verbal, nonverbal and musical expressions outweighs the delivery of musical stimuli. The effects of both interventions have also been noted to extend to carers (Wall and Duffy, 2010) and enable the potential use of carer-implemented daily musical activities (Särkämö et al., 2012). However, there is scant knowledge of *how* this can be done. In the meantime, such knowledge is critical in improving quality of care in care homes, as psychosocial interventions can be used to create efficient care practices in addition to improving residents' behaviour and mood (Lawrence et al., 2012, p, 348). Guetin et al. (2012) also noted that despite music therapists having been trained at degree level and learning heterogeneous music therapy approaches, there was insufficient evidence that these approaches contributed to the context of patients' care. This shortfall in evidence may be reflected by the fact that most studies to date (Svansdottir and Snaedal, 2006; Ledger and Baker, 2007; Raglio et al., 2008; 2010; Vink et al., 2013) have examined group therapy and have not included qualitative work to investigate how the components of the intervention work to enhance caregiving. The nature of group therapy, as opposed to individualised therapy, may also pose difficulties on exploring how such an intervention tailors to meet the diversity of individual care needs. In line with this notion, one-to-one interventions have also been identified as more efficacious than group interventions that denote a “one-size-fits-all” approach (Cohen-Mansfield and Werner, 1997; Cohen-Mansfield et al., 2010; Vernoonij-Dassen et al., 2010). Therefore, individual music therapy, a state registered health intervention emphasising the variance of treatments between individual recipients, may deserve more attention in future research.

### 2.5.2 Individual music therapy

Presently, there are very few RCT studies investigating individual music therapy in dementia care. The major references include the ones by Groene (1993), Guetin et al. (2009), Raglio et al. (2013) and Ridder et al. (2013). This paucity of research into individual music therapy in this area suggests the need for further development of such a complex intervention. According to the guidance of Medical Research Council (MRC) (Craig et al., 2008), developing a complex intervention necessitates a good theoretical understanding of how the intervention causes change. Therefore, identifying active components of the intervention and how they work to improve patients’ symptoms becomes a fundamental task. Qualitative and mixed-method research such as Ridder (2003), Ridder and Aldridge (2005), Ridder, Wigram and Ottesen (2009) may complement the quantitative studies to provide insights that help achieve this task. The following paragraphs will accordingly discuss these few existing studies.

Groene (1993) conducted a RCT study (n=30) examining the effects of 7 daily 15-minute 1:1 music therapy sessions and reading sessions on wandering behaviour. The participants were assigned to either five sessions of music therapy and two reading, or five sessions reading and two music therapy. The study found no significant difference between the two groups.  McDermott et al. (2013) rated the study as a low-quality trial, derived from issues such as employing a very short intervention period over 7 days without follow-up assessments and invalidated outcome measures (e.g. videotaping the sessions to assess seating time). Although the author provided limited information indicating how the intervention worked, participants' music and reading preference histories were taken into account to tailor the treatments.

Another RCT (n=30) by Guetin et al. (2009) also underscored the use of music according to participants' personal experience and taste in individual music therapy treatment. Individual music therapy and reading sessions were again compared in this study. However, the study examined the effects of these interventions on depression and anxiety for people with mild to moderate Alzheimer's disease. Anxiety and depression were assessed with the Hamilton Scale (Hamilton, 1967) and Geriatric Depression Scale (GDS) questionnaire (Sheikh et al., 1991) over 16 weeks of weekly treatment. The authors found significant improvements in the music therapy group and lasting effects up to 8 weeks after the discontinuation of the treatment. A receptive music therapy method to stream music via headphones was employed in the music therapy treatment. The authors explained how the sessions worked to induce relaxation by implementing a 20-minute U-sequence. This technique involved a descending 'U' phase, reducing the elements of music including tempo, volume and texture to bring the participants to a maximised state of relaxation. This phase was followed by an ascending 'U' phase that was enlivening by increasing the three elements of music. The authors did not discuss how and why reducing tempo from a range between 80 and 60 beat per minute to a range between 40 and 30 could generate relaxation (p. 39). However, they suggested that this was due to neurophysiological effects of music, which may act on the stimulation of sensory fibres and memory encoding as well as the modification of mood, behaviours and psychomotor functions. Further understanding of the physiological mechanisms of music would require the use of brain imaging techniques such as positron emission tomography and functional MRI (p. 45). The study suggested this music therapy technique was simple to implement in a multidisciplinary care approach but, again, did not provide further information regarding implementation methods or strategies.

Individualised music listening was also tested in a crossover trial (n=17) by Raglio et al. (2013). They compared music listening with individual active music therapy, which involved active interaction between the therapist and client in the sessions.  The authors tested the effects of both interventions on behavioural disturbances in moderate to severe dementia. The participants all received biweekly 30 thirty-minute individual music therapy sessions and individualised music listening sessions with a two month wash-out period in between. The Neuropsychiatric Inventory (NPI) (Cummings et al., 1994) and Cohen-Mansfield Agitation Inventory (CMAI) (Cohen-Mansfield et al., 1989) were used to assess behavioural disturbances. The authors found no significant differences between the two interventions. However, music therapy had a larger effect on symptoms. The authors ascribed this effect to the relationship and direct interaction between the therapist and participants in the sessions. It is important to note that the receptive music therapy method employed by Guetin et al. (2009) required the participants to be masked so that they could concentrate on listening to pre-selected music as the sole auditory stimulus without interference from any visual stimuli. This differs significantly from the active and improvisational approach employed by Raglio et al. (2013). The direct therapist-client interaction, understandably, would provide visual stimuli including the therapist's facial expressions, body movements as well as auditory stimuli including the music and therapist's vocal expressions. Moreover, instead of pre-selected music, the music in the sessions was live and improvised as part of the therapist-client communication. This means that the parameters of music such as volume, tempo and timbre would need to be manipulated timely during the sessions in order to facilitate the dyadic communication. Therefore, Raglio et al. (2013) suggested that the active approach focusing on therapist-client interaction was more flexible than music listening in terms of using regulative stimuli that were customised to the patients' needs.

Ridder et al. (2013) also carried out a crossover randomised trial (n=42) and found that biweekly individual active music therapy over six weeks did not significantly improve the frequency of agitation and quality of life as compared to standard care alone. However, there was a significant decrease in agitation disruptiveness ($p = 0.027$) with a medium effect size ($d= 0.50$). This significant outcome was measured by the CMAI (Cohen-Mansfield et al., 1989). Interestingly, the 5-point scale of agitation disruptiveness (i.e., 1=never to 5= extremely) was judged subjectively by the raters – in this case, the care staff. Cohen-Mansfield et al. (1991) specified that "inter-rater reliability does not exist for judging disruptiveness, and we do not necessarily expect raters to agree on this aspect of the CMAI. It is however useful for assessing the impact of the behaviour in clinical trials, especially when the study objective is to accommodate the behaviour rather than changing it" (Cohen-Mansfield et al., 1991, p.3). This suggests that whilst the individual music therapy sessions in the study might not have prevented the occurrence of agitation, they might have changed carers' perception or management of disruptive behaviours. This was in some way reflected by the fact that the intervention group had unchanged psychotropic medications whilst the standard care group had increased prescriptions. Moreover, the authors ascribed the greater effect on agitation disruptiveness to an established individual treatment with effective procedures for collaboration and exchange between staff and music therapist (p.676). This indicates a vital link between music therapists, multidisciplinary care approach and the wider community in care homes. Ridder et al. (2013) further stressed that "individual music therapy is not successful unless therapist, staff and relatives are aware of their roles in bringing the positive results from the music therapy process outside the individual relation, and bring change in daily life as well" (Ridder et al., 2013, p.676).

For future research, they also suggested that "qualitative and quantitative studies of how music therapists can complement individual therapies with advice-giving and support of staff using music in daily life activities are also warranted" (Ridder et al., 2013, p.676).

These insights once again highlight that providing information to support staff would allow music therapy to play a role in strengthening a multidisciplinary care approach. This makes it necessary to identify what information from individual music therapy sessions could help carers practically in their day-to-day job. This information would also need to be based on certain theories to underpin its goals and value. Within the framework of person-centred care (Kitwood, 1997b), Ridder et al. (2013) regarded fulfilment of psychosocial needs as the goal of music therapy. They also saw decreasing agitation as a by-product of meeting psychosocial needs. The authors further related their approach to theories such as intrinsic communicative musicality (Trevarthen, 1999; Malloch and Trevarthen, 2009) and the polyvagal theory (Porges, 2001; 2004; 2009a; 2009b; 2010) to promote initiative, social engagement, self-expression and mutual understanding (Ridder, 2003; Ridder and Aldridge, 2005, Ridder, Wigram and Ottesen, 2009). With these theoretical underpinnings in mind, music was then used in the trial (Ridder et al., 2013) to catch attention, regulate arousal level and engage in social communication in the therapy sessions (Ridder, 2011). The method was detailed in two previous mixed method studies (Ridder and Aldridge, 2005; Ridder, Wigram and Ottesen, 2009), and features the use of singing and familiar songs in the constitutional, regulative, dialogical and integrate aspects. These theoretical and practical aspects may provide a basis forming the music therapist-carer communication, though further exploration and testing of this is required.

At the present time, there is a relative paucity of quantitative and qualitative research into individual music therapy for managing neuropsychiatric symptoms of dementia. The existing studies have indicated potential short-term effects on symptoms and behaviours such as depression, anxiety and agitation disruptiveness. However, these studies employed heterogeneity of treatment lengths ranging from 6 weeks up to 6 months. The dosage also varied between weekly and daily. Despite the variety of treatment provision, most of the studies employed an active approach through live interactive music making, moving, dancing and singing (Groene, 1993; Ridder and Aldridge, 2005, Ridder, Wigram and Ottesen, 2009, Ridder et al., 2013). One study employed a receptive method by using headphones to stream music to the participants (Guetin et al., 2009). Taken together, individual music therapy sessions may involve music listening to induce relaxation as well as familiar songs to interactively influence attention, arousal and social engagement. Moreover, gathering information including personal histories and preferences of music appears to an important element of the music therapy practice to tailor the treatments. However, these studies gave little details of how life stories and songs or music with a personal meaning worked to facilitate the therapeutic process. Likewise, theoretical concepts such as affect attunement, arousal regulation and personhood were drawn to support therapist-patient interaction, which form the basis of such therapy. However, there was limited explanation of how the interaction worked to reduce symptoms. In order to tackle this issue, Ridder, Wigram and Ottesen (2009) suggested that research data showing connections and patterns between behaviours and stimuli could be collected to provide knowledge of how the change happened in the therapeutic relationship and led to therapeutic effects (p. 107). By breaking down the interaction into behaviours, music, stimuli and other constituent elements, agents of change may be illuminated to explain the mechanisms of this intervention. This may also warrant the support of physiological research methods to help investigate the underlying mechanisms of musical properties (e.g., rhythm, melody and timbre) and therapists' facial, bodily and vocal expressions during the process of therapy sessions. The measurement of heart rate and heart rate variability (Ellis, Koenig and Thayer, 2012) has emerged as a useful tool to measure such aspects. This method has been previously employed to either understand the process of therapy sessions (Ridder, 2003; Ridder and Aldridge, 2005) or assess the effects of music therapy (Okada et al., 2009; Raglio et al., 2010b).

Another knowledge gap emerging from these studies is the lack of discussion of how music therapy contributes to patients' care and whether the role of music therapists has certain functions beyond therapy sessions. However, a link between music therapy and patients' care was suggested through information sharing between music therapists and the multidisciplinary care team (Ridder et al., 2013). Accordingly, this notion would warrant further research of identifying the types of information and methods of information sharing that can be helpful to the care team. Moreover, how to effectively implement methods of information sharing in care settings also warrants exploration in order to establish the extent to which individual music therapy enhances the multidisciplinary care approach.

Despite the lack of research, the existing studies have highlighted several constituent characteristics of music therapy i.e., personal history, familiar music and songs, therapist-client interaction and therapist-carer communication. Each of these characteristics deserves further understanding. Research findings from other relevant disciplines such as psychophysiology and affective neuroscience may be drawn to shed light on the underlying mechanisms. Above all, individual music therapy, like other psychosocial interventions, would require active staff involvement to maximise its potential. The mechanisms of this therapy and its link to caregiving are important areas of research to focus on when theorising and piloting such a complex intervention.

## 2.6 Components of individual music therapy: Emerging theories from affective neuroscience

### 2.6.1 Introduction: Re-conceptualising therapist-client interaction

Regardless of the various theoretical approaches to music therapy, whether Nordoff-Robbins, psychoanalytically-informed, psychodynamic, developmental or humanistic, therapist-client interaction is the centre of this intervention (Odell-Miller and Sandford, 2009). Stern's (1985) theory of *affect attunement* has been widely used to underpin this interaction in music therapy across clinical fields, such as autism (Kim, Wigram and Gold, 2009), eating disorder (Trondalen and Skarderud, 2007; Lejonclou and Trondalen, 2009) and dementia (Raglio et al., 2006; 2008). *Affect attunement*, a term coined by Stern (1985), refers to non-verbal mother-infant exchanges used to attain an intersubjective experience of emotion. Affect attunement includes major concepts such as *vitality affect*, which describes the dynamic and kinetic qualities of feelings, and *vitality form*, which denotes the styles of actions (Stern, 1985; 2010). These feelings and action styles can be demonstrated through musical expressions, such as ascending or descending melodic contours or suddenly increased tempo and volume to match body movements. To apply these concepts in music therapy, a therapist may intuitively use an ascending glissando on the piano to match a client's momentary surge of energy, manifested by his suddenly raised arms in the air. Subsequently, the client would perceive that his arm movements are being matched by the music. In the end, this perception of two different expressive modalities matching each other (arm movements matched by glissando) is *amodal perception*, which enables the client to gain a shared understanding of an affective state. However, as Stern (1985) stated, the attunement process is a commonly occurring phenomenon and can occur rapidly and largely unconsciously. Such a phenomenon has also been observed between care home residents and their carers (Häggström, Jansson and Norberg, 1997). Therefore, it is unclear as to what makes the music therapist-client interaction unique as other everyday interactions which can also incorporate elements of affect attunement. As previously mentioned, the trial study by Raglio et al. (2013) found no significant difference between individual music therapy utilising therapist-client interaction and individualised music listening without this interaction. Therefore, the therapeutic effects of affect attunement on neuropsychiatric symptoms of dementia are yet to be confirmed by further evidence.

If music plays a critical role in making affect attunement effective in music therapy, there has been little scientific explanation addressing how the mechanisms of music facilitate the attunement process. One explanation stemming from a psychoanalytical and psychodynamic tradition is provided by Odell-Miller (1995; 1997) and Darnley-Smith (2004). These authors suggested that music, such as improvisation and pre-composed materials, in therapy allowed verbal elements to emerge, establishing a link between music and meaning. This enabled the therapist and client to work out issues through transference and counter-transference in the therapeutic process. Another explanation by Ridder (2003; 2005) is that music, particularly the therapist's singing, regulates patients' arousal. It is important to note that arousal has been considered as one of the building blocks of emotions (Sander, 2013). It has also been conceptualised as a psychophysiological reaction in the body (Sachter and Singer, 1962) that can be measured by the indices of autonomic nervous activity, such as skin conductance and heart rate (Duffy, 1957). Ridder (2011) later elaborated the notion of arousal regulation, using the polyvagal theory (Porges, 2001; 2004; 2009a; 2009b; 2010), which denoted the phylogenetic development of the autonomic nervous system and the vagal innervation of the heart, muscles of the face and the middle ear and vocal apparatus, that regulate the expression of emotional and social behaviour. According to Ridder (2011), songs are used to entrain clients' physiological parameters such as breathing. She explains that “the therapist chooses songs which initially match the client’s level of arousal. The therapist then slowly regulates the client by modifying musical elements such as dynamic, tempo and pitch” (p.138). Moreover, the polyvagal theory introduces the concept of *neuroception*, which delineates how neural circuits distinguish whether a situation or person is safe or dangerous and, accordingly, activates either prosocial or defensive behaviours (Porges, 2004). Therefore, Ridder (2011) underscored the use of both acoustic and visual cues, such as therapists’ voices, faces and movements, to trigger clients’ physiological states of safety and to activate their attention and memory which subserves social engagement. It is worth noting that the neurovisceral integration model proposed by Thayer and Lane (2000; 2009) sheds further light on the notion of emotion regulation. However, this model emphasises the adaptable communication between the brain and the heart as a result of successfully coping with environmental demands. This communication pertains to the command from the right prefrontal cortex via other subcortical brain structures, including, the amygdala and medulla, vagus nerve, and, eventually, the heart. When exposed to threat and stress, the inhibition of prefrontal activity disables the brain-heart communication to allow the subcortical structures such as the amygdala to take charge of automatic fight-or-flight response without delay (Arnsten and Goldman-Rakic, 1998). Physiologically, this can be manifested by the increase of heart rate (beat per minute) and decrease of heart rate variability (the variable duration between beats). Following from this, increased heart rate variability has been suggested by both the polyvagal and neurovisceral integration theories to be an index of successful emotion regulation in response to environmental challenges.

By relating to the polyvagal theory, Ridder (2011) introduced a neurobiological thesis into conceptualising therapist-client interaction in music therapy. Therefore, this interaction may not only be understood by observable behaviours, but also by what physiologically goes on in a client's brain and body during the interaction. The brain imaging study by Di Cesare et al. (2013) demonstrated that the recognition of vitality forms involves the activation of the dorsal-central aspect of the insula. This brain area connects the somatosensory areas with the hippocampus, a region that may function to store and retrieve memories associated with specific vitality forms (p. 9). The dorso-central insula has also been reported to be activated via certain unmyelinated cutaneous fibres when skin is caressed and when observing individuals who are being caressed (Morrison et al., 2011). Therefore, the study by Di Cesare (2013) gives rise to the neural basis of Stern's concept of *vitality form*, explaining one's capacity to understand the meaning of an observed action through how the action is performed. Essentially, identifying the functional roles of neural regions involved in specific neural pathways allows one to deduce the causal relationship between stimuli and behaviours. This may be of use in understanding clients' behaviours in response to therapists' actions, in which facial, vocal, bodily expressions are as equally important as musical expressions. Further understanding of the neural and affective mechanisms of these expressions may lay a theoretical foundation, which articulates the ideology of therapist-client interaction.

### 2.6.2 Facial expressions

Facial expressions are one of the major means of nonverbal communication including body movements and vocal qualities, sending emotional signals and information gathered by vision. Facial muscles are controlled and innervated by different branches of the 7$^{th}$ cranial nerve emerging from the basis of the brain between the pons and the medulla oblongata. They are also under the command by the central nervous system through two routes. One route controls voluntary facial muscles from the motor cortex with indirect and direct fibres to the facial nucleus where the facial nerves arise. The other route controls involuntary facial expressions from the cingulate regions and subcortical structures including the basal ganglia and hypothalamus through multisynaptic projections to the reticular formation and red nucleus to the facial nucleus (Goerge, 2013).

Developed through animal evolution, similar muscular patterns of facial movements have been observed across cultures and geographical groups (Darwin, 1872). The universality of facial expressions in humans are therefore linked to the basic emotions i.e. happiness, sadness, anger, fear, disgust and surprise (Ekman, Sorenson and Friesen, 1969). The selection of facial expressions according to basic emotions is believed to be influenced by sensory regulation in receipt of stimuli. Fearful facial expressions with widened visual field and faster eye movements may suggest enhanced perception to acquire visual information in order to steer way from danger. In contrast, an expression of disgust may suggest dampened perception (Susskind et al., 2008). Despite the generally accepted universality, the interpretation of emotional facial expressions is situational and perceptual context-dependant (Jack et al., 2009). Certain facial emotions are also found to be better recognised by the members of a common social, geographical and ethnic group (Aviezer et al., 2008).

The interpretation and recognition of emotional expressions can also be reliant on the deficits caused by brain damage. As facial emotions and identity information are thought to be processed independently from each other, brain-lesioned patients can display defects in perceiving and recognising emotions whilst showing preserved identity recognition (Young et al., 1993). Associated with the dysfunction of the insula (a structure of the basal ganglia), deficits in perceiving disgust facial expressions have been found in patients with Huntington’s, Parkinson’s disease and obsessive-compulsive disorder (Sprengelmeyer et al., 1996; Hennenlotter et al., 2004).

The anatomical manifestation of the perception of emotional faces is distributed across a wide network of cortical and subcortical brain regions. The pulvinar, a thalamic nucleus connected with other regions involved in emotions, receives inputs from the superior colliculus and projects to amygdala. It is, therefore, considered to have a role in processing unconsciously perceived fear-related expressions and rapid attention orienting towards emotional stimuli (Vuilleumier et al., 2003; Pessoa and Adolphs, 2010; Tamietto and de Gelder, 2010; Garrido et al., 2012; Tamietto et al., 2012). The fusiform, inferior occipital regions and posterior superior temporal sulcus are involved in the perceptual analysis of faces. Whilst the two prior structures are involved in recognising static facial features such as identity, the latter is primarily involved in encoding dynamic features such as changeable emotional expressions (Gobbini and Haxby, 2007; Rolls, 2007).  The superior temporal sulcus is also thought to process other features such as gaze and the integration of gaze, facial and vocal expressions (Beauchamp, 2011). Other regions including the orbitofrontal and ventromedial prefrontal cortices are found to process faces with anger and positive valenced emotions. The anterior cingulate cortex is indicated as responsive to various facial emotions e.g. happiness, anger, sadness, disgust and fear. Activation in several neocortical regions of the temporal lobe including temporal pole, inferior, middle, and superior temporal gyri has also been found during emotional face perception (Fusar-Poli et al., 2009).

The insula was originally thought to be involved in processing disgust-related facial expressions, scenes and experience (Wicker et al., 2003). This idea was later changed as the anterior insula was also found to process other facial emotions such as anger, fear, pain and happiness. The right anterior insula has been considered to have a role in self bodily and visceral sensation, pain and the empathic processes triggered by the perception of others’ emotions (Lamm and Singer, 2010; Craig, 2011). This empathic process may be manifested by the activation of an “emotional mirror neuron system” that could cover the anterior insula, amygdala, pre-supplementary motor area, right somatosensory cortices, ventral striatum and doperminergic system (Adolphs et al., 2000; Winston et al., 2003).

The amygdala, among all the structures involved in the perception of emotional faces, arises to have a pivotal role. In early research findings of animal studies, it was consistently thought to be involved in processing fear and social stimuli (Adolphs, 2010). However, Breiter et al., (1996) and Derntl et al. (2009) later found that the amygdala was also involved in perceiving facial expressions of anger, disgust, sadness and happiness. In addition, the amygdala is also found to perceive vocal and bodily expressions of fear and the cross modal integration of facial and vocal signals of fear (George, 2013). As fear can be revealed by the eyes such as widened eyes when perceiving danger, the amygdala appears to be sensitive to information conveyed by the eyes. This is demonstrated by Adolphs et al. (1994). They found that SM, a patient with a legion of the amygdala, exhibited not only impaired abilities to recognise facial expressions of fear but impaired perception of gaze direction.  When they later asked SM to specifically fixate her gaze onto the eyes of the scanned faces, her impairment in recognising fearful face became unobservable (Adolphs et al., 2005). This explains the value of gaze, especially eye contact, a communicative signal in interpersonal communication.  Conty et al. (2010) observed increased emotional arousal (skin conductance), triggered by the perception of eye contact. As opposed to averted gaze, George, Driver and Dolan (2001) found that the perception of direct gaze resulted in amygdala activation and coupling with face-responsive fusiform regions. Approach-related emotions such as anger and happiness are found to be more intensely perceived when combined with a direct eye gaze. Interestingly, faces with an averted gaze are found to intensify withdrawal-related emotions such as fear (N’Diaye, Sander and

Vuilleumier, 2009). This indicates the role of gaze direction in emotional attention as it modulates the meaning of expressed emotions. This may pertain to why making eye contact is an important aspect in therapy sessions. When eye contact is established, there is an expected change in patients' emotional states. Therapists may need to be observant of where clients shift their gaze to or away from during therapy. More importantly, it requires therapists' awareness of their own gaze to carefully utilise eye contact.

It is noteworthy that neutral faces without particular expressions may also have an emotional value as they activate a network of brain regions including the amygdala (Ishai, Schmidt and Boesiger, 2005). The overgeneralisation of emotion-related facial features is thought to be involved in this automatic process of evaluating personality traits such as trustworthiness (Todorov, 2008). Additionally, contextual information such as audio-verbal emotional information can be attached to an encountered face to influence the affective judgement of face, shaped by previous experience (Morel et al., 2012). This underlines the emotional association effects on a client who may judge a therapist's face based on the previously associated positive or negative therapy content.

Added to the affective value of neutral faces, gaze shifts also modulate the evaluation of the likeability and attractiveness of faces. Mason, Tatkow and Mcrae (2005), in their experiment, found that the faces rated with higher likeability shifted their gaze to meet the eyes of the observers. The same attentional engagement, manifested by eye contact, is found to increase the activity in the ventral striatum, a reward-related brain region of the viewers who judged the attractiveness of unfamiliar faces (Kampe et al., 2001). In the same manner, a person can acquire a positive affective judgement towards objects that are looked at by others. Objects looked at by a happy face are also liked more than objects looked at by a disgusted face (Frischen, Bayliss and Tipper, 2007). The above discussion again stresses the effects of facial expressions including gaze direction and eye contact on a person’s emotional appraisal of faces and objects. These insights shed light on the utilisation of eye gaze in affective nonverbal communication between therapists and their clients. Moreover, it denotes that objects presented to clients such as a piano or a tambourine can possess certain affective value and generate joint attention to facilitate the therapeutic process if therapists make use of their gaze.

Facial expressions can provide pivotal information for decoding or predicting a person’s inner emotional state. However, they are not the only channel signalling emotions during nonverbal and verbal communication. Communication in real-life situations such as in a therapy session involve the exchange of cross-modal cues, combining gaze and facial expressions as well as, facial, vocal, bodily and even musical expressions. Further understanding of the neural substrates and behavioural manifestations of these emotional expressions in healthy individuals and clinical populations such as patients with autism, schizophrenia and Alzheimer’s disease will deepen our knowledge of human communication and enhance health.

### 2.6.3 Bodily expressions

Our emotional states can be revealed via our face, voice and body, as discussed by several scholars (Buck 1984; 1991; 1994; Ekman, 1984; Fridlund, 1991). Buck (1994) described the *readout hypothesis* in details where “displays are both based upon fundamental motivational-emotional systems and specific to intent and context, and furthermore that the consideration of the role of subjective experience is critical to understanding why and how this is the case” (p. 111). Smiling may indicate happiness and wiping away tears may indicate sadness. Similar indications can also be observed during a music therapy session when a client makes a lively drum roll or produces a pensive piano tune. These expressive actions can intentionally and unintentionally send out communicative signals to tell the world how one feels inside. Buck (1994) suggested that “it is useful for social animals to be able to communicate their internal states of anger, fear, interest, sexual excitement and so forth, to their fellows without actually having to engage in overt behaviours associated with those states" (Buck, 1994, p. 36). Akin to emotional faces, people are able to discriminate basic emotions (Ekman, 1992) via particular body postures and movements (Laban, 1988; Stanislavski, 1936).

Body postures and movements are understood visually through their biological form and motion (Giese and Poggio, 2003). Form information, provided by body postures, consists of configural cues from body parts, the relative positions and structural hierarchy of body parts and whole-body postures (Reed et al., 2006). Motion information, provided by body movements, is made up of the changes of configural information over time, kinematics (e.g., velocity, acceleration and displacement) and dynamics, as in motion specified by mass and force (Atkinson, 2013). Studies have shown that the fusiform body area (FBA) and the extrastriate body area (EBA) are the two distinct brain regions involved in the perception of these neutral form and motion cues (Downing et al., 2001; Peelen and Downing, 2005; Schwarzlose, Baker and Kanwisher, 2005). The FBA, a body-selective area partially overlapping with the fusiform face area, has been reported to process configural information (Taylor, Wiggett and Downing, 2007). The EBA, in the lateral occipitotemporal cortex, is also considered to process viewed static bodies; particularly, individual body parts (Downing et al., 2006; Peelen, Wiggett and Downing, 2006; Taylor, Wiggett and Downing, 2007; Urgesi et al., 2007a). There is evidence suggesting that both areas are responsible for integrating configural and motion information. However, the EBA appears to have a greater role than the FBA in processing kinematics (Jastorff and Orban, 2009). Additionally, the posterior region of the superior temporal sulcus (STS) is believed to have an important role in this respect. This region is involved in processing facial and bodily movements, especially the movements of body parts (Puce and Perrett, 2003; Blake and Shiffrar, 2007). Some evidence also indicates that the STS plays a role in integrating auditory, form and motion information relevant to social perception (Puce and Perrett, 2003; Beauchamp, 2005). The ventral premotor cortex is another region of importance. It is thought to be involved in processing configural cues (Urgesi et al., 2007b), whole-body movements (Saygin et al., 2004) and the planning and visual discrimination of motor actions (Urgesi et al., 2007a). These neural substrates demonstrate a body-selective mechanism of the human brain in deciphering form and motion information. Configural and motion cues are, therefore, not only indispensable in the visual perception of bodies and their motion but also the emotions involved.

Studies using forced-choice emotion labelling tasks, where observers are asked to select a single word from a list that best describes the viewed bodily expression, have shown that people are able to identify the emotions, intentionally portrayed by static body postures (Atkinson, Heberlein and Adolphs, 2007), moving bodily expressions (Atkinson, et al., 2004; Atkinson, Tunstall and Dittrich, 2007) and dance movements (Dittrich et al., 1996; Hejmadi, Davidson and Rozin, 2000). Additionally, walking movements showing specific or self-induced emotions (Montepare, Goldstein and Clausen, 1987; Heberlein et al., 2004, Roether, Omlor and Giese, 2008; Roether et al., 2009) as well as combinations of emotionless movements (de Meijer, 1989) can also be accurately discriminated. Atkinson et al. (2004) found that emotions were more recognisable in the videotaped moving bodily expressions than in the videotaped static expressions, using the forced-choice labelling tasks. They indicated that viewers could extract various cues from the bodily motion and form to identify the emotions. Particularly, exaggerated whole-body movements aided viewers' judgement in the expressed emotions and emotional intensity. Furthermore, motion cues enable accurate judgements about the person such as identifying sex and identity from gait (Blake and Shiffrar, 2007) and through the recognition of certain kinematic and structural changes e.g., body sway (Mather and Murdoch, 1994). Interestingly, this corroborates Oliver

Sack’s observations of Mr P. in his book *The Man Who Mistook His Wife for A Hat*. He noted that “though [Mr P.] could not recognise his students if they sat still, if they were merely ‘images’, he might suddenly recognise them if they moved. ‘That’s Karl,’ he would cry. ‘I know his movements, his body-music’” (Sacks, 1998, p.18). This suggests that motion cues are superior to static form cues as in providing reliable information about individuals, based on their actions.

In order to understand which features of body movement or postures humans use to communicate emotions, previous research has utilised the link between the science and arts. This is demonstrated through systematic analyses of gait, acted expressions, dance and music performance (Montepare et al., 1987; de Meijer, 1989; Aronoff, Woike and Hyman, 1992; Wallbott, 1998; Dahl and Friberg, 2007). Wallbott (1998) found that emotions portrayed by actors and actresses could be differentiated via various distinctive patterns of whole-body movements including quality and vigour. For example, sad and disgusted bodily expressions tend to involve movements that are passive with low-energy. These movements can be characterised by downward-moving heads and forward-moving shoulders. In contrast, high-movement dynamics are involved in hot anger whilst moderate movement dynamics are involved in cold anger and fear.

Aronoff, Woike and Hyman (1992) studied ballet movements and postures and concluded that threat could be manifested by angular and diagonal body patterns whereas warmth was conveyed by round body patterns. Also examining dance sequences, Sawada et al. (2003) found that the observers utilised the velocity, acceleration and displacement of arm movements to distinguish joy, sadness and anger. These results add to previous findings by De Meijer (1989), which suggested that surprise and fear could be displayed through dance movements with fast velocity. Additionally, the observers in De Meijers’ (1989) study utilised dance patterns, such as stretching movements with straight trunk and legs or bowed trunk and head with bent knees, to distinguish between negative and positive emotions.

A study by Dahl and Friberg (2007) asked viewers to rate musicians' movements in silent video clips. The authors found that the viewers were able to rely on motion cues to determine intentionally conveyed emotions including happiness, sadness, and anger but not fear. For example, sadness was communicated through fluid, slow movements whereas anger was expressed with jerky, fairly fast, large movements. In addition, different instruments also influenced how the same emotion was communicated. To express happiness, for example, the saxophonist's movements were slow, fluid, and large whereas the bassoonist's were fast and jerky. These research findings suggest that sounds may not be the only aspect used within a musical cue to communicate emotion. Body movements are also one constituent component of such a cue. The combination of sounds and movements narrates the emotional intentions of a person who is playing an instrument. This is of relevance within music therapy sessions, where therapists and patients communicate through their body language and joint music making. By attending to patients' movement cues, therapists may come to understand their patients' emotional states. This may be explained by the idea of *emotion contagion*, which proposes that the perception of another's emotions and related behaviours trigger similar emotions and behaviours in ourselves (Hatfield, Cacioppo and Rapson, 1993). This theory is supported by the discovery of mirror neurons (Gallese et al., 1996; Rizzolatti et al., 1996), which later led to the proposition of the neural basis of empathy. Viewing a person's action activates a network of parietal and premotor cerebral areas within the observer, as if the observer was undertaking a similar action and experiencing a similar emotion (Gallese et al., 2004; Leslie, Johnson-Frey and Grafton, 2004). Adding to this notion, de Gelder et al (2004) found that fearful body postures activated the brain regions involved in motor planning and actions, including the supplementary motor area, inferior frontal and precentral gyri. This suggests that the viewed images triggered the brain to begin preparing the observer for subsequent appropriate actions, such as flight.  In addition, the connections from amygdala to somatosensory and insula cortices have also been noted to facilitate this simulation account and thus allow emotion understanding (Adolphs and Spezio, 2006).

The understanding of emotions expressed through the human body can be further explained anatomically by the involvement of several key regions in the brain. The amygdala is thought to be a major source in processing bodily expressions and the corresponding emotional modulation. It appraises the emotional valence and significance of the viewed body and allocates attentional or processing resources to the EBA and FBA which extract and integrate kinematic and static form cues (Atkinson, 2013, p. 210). However, there is also evidence from lesion studies to indicate that the amygdala might not be necessary in the perception of emotional bodies. This is demonstrated in patients with bilateral amygdala damage who still recognise fear normally with the forced-choice tasks (Adolphs and Tranel, 2003; Heberlein et al., 2004; Heberlein and Saxe, 2005; Atkinson, Heberlein and Aldophs, 2007). The medial prefrontal cortex (MPFC) and left superior temporal sulcus (STS) have also emerged to have a potential role in understanding and categorising others' emotional states. As one emotion can be portrayed through multiple sensory modalities (i.e. bodily, facial and vocal expressions) or the combination of these, the MPFC and left STS are found to help perceive this emotion in abstraction from these modalities (Peelen, Atkinson and Vuilleumier, 2010).

The above discussion of research findings has provided insights into the understanding of emotional body communication. This could form a theoretical basis to help music therapists interpret or understand their patients' feelings in therapy. In order to facilitate dyadic communication and attain certain goals in therapy, therapists' own bodily expressions and the associated emotions are equivalently important. A therapist's emotional body may contribute to the quality of nonverbal communication and would also merit equal attention. Early research by Harrigan and Rosenthal (1983) found that physicians who leaned forward with open arm positions and nodded their head were judged more positively on their empathy and rapport with the patients. This underlines that head position (up, down and tilted), trunk angle (forward, straight and backward) and particularly, leaning direction impacts on the inference of attitude and affective states (Mehrabian, 1968; Harrigan and Rosenthal, 1983). Accordingly, leaning direction along with exaggerated whole-body movements, as mentioned earlier, may aid patients' perception of therapists' emotional intentions and intensity in music therapy. The utility of therapists' body form and motion cues may therefore require further exploration and understanding in order to develop therapeutic techniques that enable intersubjectivity. This may be an interesting avenue for future research of music therapy where nonverbal communication formed by emotional face, body, voice and music cues could precede the meaning of words.

### 2.6.4 Vocal expressions

The meaning of words is not the only source relied upon when transferring information through speech communication. The same word or sentence spoken with different tones can convey completely different messages, which is why the sound of human voice can be a very reliable and powerful means of communication. When a person speaks, listeners are able to infer the speaker's origin, age, gender and current emotional state. Early research has indicated that a speaker's emotional state is predominantly conveyed by the voice rather than the vocabulary used by the speaker (Mehrabian and Ferris, 1967; Mehrabian and Wiener, 1967). To understand an emotional state of a speaker, two major vocal cues are referred to: speech prosody and nonverbal vocalisation (Brück, et al. 2013). Speech prosody is made up of modulations in voice pitch, voice quality, loudness and speech rhythm (Banse and Scherer, 1996). For example, a 'happy' speaker tends to speak quickly and loudly, with a raised pitch. But when feeling sad, a person speaks slowly and quietly, with a lowered pitch. Other nonverbal vocalisations including sighs, sobs, screams, groans, moans or laughter have been referred to as *vocal affective bursts* (Scherer, 1994). Although not as elaborate as speech, these vocalisations effectively carry emotive signals that can be decoded with high accuracy by listeners (Schröder, 2003). In vocal communication, certain emotions may most often be expressed through short vocal affective bursts instead of speech cues, despite comparatively low recognition rates (Banse and Scherer, 1996). Although disgust, expressed by vocalisations such as '*yuck'* and '*eww'*, is an example that has a higher recognition rate among affective bursts (Schröder, 2003). Both speech prosody and nonverbal vocalisation provide affective acoustic cues. Research has shown that the perception of these cues involves distinctive networks of brain regions and the activation of these networks can also be translated into certain behavioural manifestations. The ensuing discussion will respectively outline the relevant research findings regarding this topic.

#### 2.6.4.1 Speech prosody

In a meta-analysis, Juslin and Laukka (2003) found that the accuracy rates of decoding prosodic acoustic cues to infer various emotions were above chance level. Anger and sadness were deciphered with the highest accuracy, followed by fear and happiness. Prosodic cues expressing love and tenderness were noted to show the lowest accuracy. In terms of the neural processes, a widespread network, including the superior temporal, inferior frontal and subcortical structures (e.g., the amygdala), is believed to be involved in prosody comprehension (Ackermann and Riecker, 2004; Schirmer and Kotz, 2006; Wildgruber et al., 2006; 2009). Research has indicated that the structures within this network have different functional roles, which can be understood separately via stimulus-driven activation (i.e. brain activation by acoustic features such as intensity, frequency and duration) or a task-dependent profile (i.e. brain activation by cognitive demands such as categorisation and recognition) (Wildgruber et al., 2009).

Stimulus-driven activation has been found in the mid-superior temporal cortex (m-STC) (Wiethoff et al., 2008). Aspects of this region, such as the middle parts of the right and left superior temporal cortex, display heightened sensitivity to human voice, including cries, coughs, laughter and speech, relative to the sounds of music, machines and animals (Belin et al., 2000; Belin, Zatorre and Ahad, 2002; Belin and Zatorre 2003). The m-STC or 'temporal voice area' (Belin and Grosbras, 2010) has therefore been identified as voice-sensitive, regardless of emotional connotation (Ethofer et al., 2011). However, imaging studies have also found enhanced activation of this region in response to emotional voices (Grandjean et al., 2005; Ethofer et al., 2007; 2009; Wiethoff et al., 2008). This enhanced activation has been linked to increases in the emotional intensity of a voice (Ethofer et al., 2006) as well as the processing of erotic prosody (Ethofer et al., 2007). Wiethoff et al. (2008) instructed 24 adults to passively listen to words spoken in neutral, happy, erotic, angry or fearful prosody, whilst monitoring their hemodynamic responses. The participants were not focusing their attention on classifying emotions, as they were told that the experiment was to examine differences in the perception of adjectives versus nouns. The authors found significantly stronger responses in the right m-STC as well as correlations between these responses and acoustic features such as mean intensity, mean fundamental frequency and stimulus duration. However, none of these acoustic parameters alone were found to have contributed sufficiently to the increased activation in m-STC. Therefore, based on this observation, the authors propose that the m-STC contributes to the perceptual analysis of complex acoustic patterns related to speech prosody (Wiethoff et al., 2008). This underlines that the stimulus-driven activation of the m-STC has a functional role in the perception of emotions via vocal acoustic properties, irrespective of task demands or attention focus.

In contrast to stimulus-driven activation, task-dependent activation is normally generated by focusing attention on naming or labelling vocally expressed emotions (Brück et al., 2013, p. 268). Various activation patterns have been observed within the frontal and temporal cortex during such tasks (Mitchell et al., 2003; Wildgruber et al., 2004; Ethofer et al., 2006; Quadflieg et al., 2008; Ethofer et al., 2009). When participants were asked to label the emotions of short German sentences spoken with five target emotional verbal utterances, Wildgruber et al. (2005) found enhanced activation within the right posterior superior temporal cortex (p-STC) and the inferior frontal cortex (IFC). Interestingly, similar prefrontal regions have been linked to working memory functions (d'Esposito et al., 1998; Chein, Ravizza and Fiez, 2003). This suggests that emotional prosody comprehension might also demand working memory processes, based on similar frontal lobe involvement in both processes (Mitchell, 2007). This link between working memory and the decoding of affective prosodic cues may be observed in music therapy. For instance, patients may pick up on and repeat short, emotionally salient prosodic cues or melodic vocalisations produced by their therapists.

The p-STC, on the other hand, has been found to be a major site of integrating auditory and visual nonverbal emotional signals (Kreifelts et al., 2007). However, this audio-visaul integration also relies on modality-specific brain regions such as the fusiform face area (FFA) (Kanwisher et al., 1997) and temporal voice area (TVA) (Belin et al., 2000), during the stages of perceptual analysis. Simultaneously seeing an emotional face and hearing an emotional voice may induce an involuntary process of audio-visual binding (Pourtois et al., 2000) that facilitates emotional judgements (Massaro and Egan, 1996; de Gelder and Vroomen, 2000; Dolan, Morris and de Gelder, 2001; Kreifelts et al., 2007). Vocal expressions, when complemented by facial expressions, may enhance the understanding of a person's affective state. At the same time, different affective vocal signals may change or modulate the interpretation of emotional information conveyed by facial expressions (Ethofer et al., 2006; Müller et al., 2011). For example, de Gelder and Vroomen (2000) found that pictures of neutral faces could be perceived as fearful, when complemented by a fearful voice. These research findings may provide a theoretical notion that calls for music therapists' awareness of the combined effects of both facial and vocal expressions in interactions with patients. It might be necessary for therapists to utilise affective signals carefully via pronounced speech prosody or nonverbal vocalisations that are augmented with consistent facial expressions. Patients with cognitive deficits might particularly benefit from these processes, which enable better detection of affective information.

It is also important to note that activation in the p-STC and IFC is believed to occur during an explicit mode of processing that delineates active cognitive evaluation of vocally expressed emotions. Contrarily, implicit processing which occurs without intentional allocation of attention to interpret prosodic signals is believed to involve a network that includes the limbic structures and amygdala (Critchley et al., 2000; Hariri et al., 2003; Tamietto and de Gelder, 2010) as well as the anterior rostral mediofrontal cortex (arMFC) (Sander et al., 2005; Ethofer et al., 2006; Bach et al., 2008; Wiethoff et al., 2009; Szameitat et al., 2010). Such implicit processing has been observed to be inhibited by explicit attentional processing (Blair et al., 2007; Mitchell et al., 2007). In other words, engaging someone in actively attending to emotional prosody may dampen limbic activation, which subserves involuntary emotional reactions. Once again, this may serve as a theoretical notion in the practice of music therapy.

#### 2.6.4.2 Nonverbal vocalisations

As discussed earlier, nonverbal vocalisations or affective bursts (Scherer, 1994), such as sighs, sobs, screams, groans, moans and laughter, can express different emotions based on a variety of acoustic profiles (Banse and Scherer, 1996; Juslin and Laukka, 2003; Sauter et al., 2010). Sauter et al. (2010) found that different combinations of the acoustic properties of nonverbal vocalisations, including amplitude (i.e. intensity), pitch and spectrum (i.e. timbre), helped predict specific emotions. Particularly, the authors suggested that variation of tone quality was a dominant cue for emotional nonverbal vocalisations. This differed from studies of emotional speech, where pitch was found to be a dominant cue for emotional evaluation. Nonverbal vocalisations share similar brain regions that are responsible for speech prosody. These include the superior temporal cortex (Meyer et al., 2005; Sander and Scheich, 2005; Meyer et al., 2007; Scott et al., 2009), basal ganglia (Morris, Scott and Dolan, 1999) and amygdala (Fecteau, 2007). The understanding of nonverbal vocalisations is presently limited, especially in comparison with the considerable amount of research into speech prosody. However, most of the research to date has centred on the neural processes of laughter (Brück et al., 2013). The modulations of voice pitch, loudness and duration of laughter segments have been used to infer a person's affective state (Szameitat et al., 2009; Szameitat et al., 2011). Studies have observed the involvement of the superior temporal, frontal and limbic areas in the perception of laughter (Sander and Scheich, 2001; 2005; Meyer et al., 2005; 2007; Szameitat et al., 2010). Additionally, different types of laughter have been found to have various neural manifestations and communicative functions. For example, the right mid-superior temporal cortex (m-STC) is associated with laughter elicited by tickling which may indicate social bonding derived from playful interactions. The anterior rostral mediofrontal cortex (arMFC) is associated with laughter that taunts or rejects someone as well as joyous laughter that invites people to join in (Szameitat et al., 2010). In the context of therapy, laughter from either the therapist or patient may follow similar principles of such social contexts and generate certain effects on the dyadic interaction. Whilst the acoustic properties of laughter denote certain emotional significance, the timings of laughter might also carry some weight in the context of therapy. Exploration of various time points of laughter over a therapy session might help understand the function of such nonverbal vocal expression in the therapeutic process.

The above discussion has outlined the human ability to detect emotional messages from vocal expressions that can be understood via speech prosody and nonverbal vocalisations. The underlying neural mechanism for this ability has been found in the complex interaction between several cortical regions. The frontal lobe is implicated in the explicit attentional evaluation of emotional voices. The posterior superior temporal cortex (p-STC) is involved in the perceptual analysis of acoustic parameters and audio-visual integration. The audio-visual or multimodal binding of emotional cues is an important mechanism used to enhance affective understanding in human communication in real life situations. Brück et al. (2013) proposed a model of audio-visual integration through two neural circuits. One is via an explicit processing route: auditory and visual signals are extracted from respective sensory-specific primary cortices and then integrated into a single percept within the p-STC. Subsequently, cognitive evaluation of such combined emotional signals occurs in association with the activation of inferior and orbitofrontal structures. The second is an implicit processing route where emotional signals are unconsciously sent to the limbic system, which induces emotional reactions. This implicit route may shed light on an occasional observation in care homes; a carer’s facial expressions and vocal tone, if not carefully utilised, can at times unintentionally elicit agitated behaviours from a resident with dementia. Impaired voice discrimination and vocal gender perception have been reported in patients with Alzheimer's disease (Halistone et al., 2011). However, the abilities to perceive emotions via speech prosody have been found to be retained in this clinical population (Drapeau et al., 2009). This suggests that utterances can 'speak volumes'. In addition, acoustic properties such as timbre, voice pitch and pitch variation are all vital emotional indices (Banse and Scherer, 1996; Juslin and Laukka, 2001; Bänziger and Scherer, 2005; Sauter et al., 2010). Music therapists may utilise these features in speech or singing within sessions to convey or perceive emotional messages.

### 2.6.5 Musical expressions

As previously mentioned, music is not the only component of music therapy. When a music therapist and patient play music together, they are very much like orchestra players who do not merely communicate through the sound of the music but also their whole-body expressions. However, music is undoubtedly a unique means of human communication. The social cohesion, cooperation and action coordination involved in music making denotes the social functions of music, which may be implicated in human survival instinct and individual emotional wellbeing (Koelsch, Offermanns and Franzke, 2010).

Music has been found to elicit emotions and generate the related changes in psychophysiological domains (e.g., heart rate, respiration and skin conductance) (Krumhansl, 1997) and neurochemical systems (e.g., dopamine neurotransmitter, cortisol and oxytocin hormones) (Chanda and Levitin, 2013). Several mechanisms of emotion induction through music listening has been suggested. These include brain stem reflexes, episodic memory, music expectancy, emotional contagion, evaluative conditioning and visual imagery (Juslin and Västfjäll, 2008). These mechanistic features can also be understood through the activation patterns of various cerebral regions and can be reflected by the relevant behaviours, such as the motivation for movements (Bharucha and Curtis, 2008).

The amygdala, a significant structure involved in both positive and negative emotions (Hamann et al. 2002, Eldar et al., 2007; Murray, 2007), is made up of several nuclei (e.g., cortical, basal, accessory basal, central, lateral, medial neuclei) (Koelsch, 2013). These components of the amygdala have been reported to show different reactivity to consonant and dissonant music. For example, decreased Blood Oxygen Level Dependent (BOLD) signals have been observed in the superficial and centromedial amygdala in response to both consonant and dissonant music. Comparatively, the basolateral amygdala display increased BOLD signals to both types of music (Ball et al., 2007). The central aspect of the amygdala is functionally connected to other brain structures including the hippocampus, parahippocampus and temporal poles. These regions have been observed to show an increase of BOLD signals in response to dissonant music. Interestingly, whilst BOLD signals decrease in these regions, such signals increase in response to consonant music in the anterior insula and the ventral striatum, which connects with the superficial aspect of the amygdala (Blood et al., 1999; Gosselin et al., 2006; Ball et al., 2007; Sammler et al., 2007; Khalfa et al, 2008; Müller et al., 2011). Amygdala reactivity to musical stimuli has been reported in studies of healthy subjects (Blood and Zatorre, 2001; Baumgartner et al., 2006; Koelsch et al., 2006; Ball et al., 2007; Eldar et al., 2007; Koelsch et al., 2008; Lerner et al., 2009) as well as patients with brain lesions (Gosselin et al., 2005; 2007; Dellacherie, Ehrlé and Samson, 2008). Moreover, two studies found reduced emotional responses in patients whose parahippocampal cortex was removed as part of the medial temporal lobe (Gosselin et al., 2006; Khalfa et al., 2008). This observation corroborates the results of other studies that show changeable activation in the parahippocampal gyrus, especially within the middle part of this area, in response to variable dissonant music stimuli (Blood et al., 1999; Koelsch et al., 2006). Therefore, such a region is thought to be responsible for processing acoustic roughness and identifying the emotional information of vocal signals (Koelsch, 2013).

Similar to the aforementioned audio-visual integration, interaction between musical and visual information has been reported in studies using a combination of music and photographs (Baumgartner et al, 2006) or films (Eldar et al., 2007). In the study by Eldar et al. (2007), stronger brain activity was generated from the perception of combined emotionally neutral film clips and positive (joyful) or negative (scary) music, compared to when either music or films were presented alone. In addition, negative scary music combined with neutral film clips generated stronger activation in the amygdala, anterior hippocampus and the lateral prefrontal cortex than positive joyful music combined with the same clips. Based on these results, the authors suggest that emotions are processed together with the relevant contextual representations. This highlights the real world content used in processing emotions. Therefore, audio-visual integration pertains to music therapy sessions as therapists assemble their visual (facial and bodily) and auditory (vocal and musical) expressions to ameliorate patients' emotional disorders in real-word interpersonal interaction.

A sizeable body of research has also focused on the role of the hippocampus, particularly the anterior hippocampal formation, in processing music and emotions (Blood and Zatorre, 2001; Brown et al., 2004; Fritz and Koelsch, 2005; Baumgartner et al., 2006; Koelsch et al., 2006; Eldar et al., 2007; Mitterschiffthaler et al., 2007). The hippocampus is mainly thought to play a key role in memory, learning, expectedness, novelty and spatial orientation (Moscovitch et al., 2006; Eichenbaum, Yonelinas and Ranganath, 2007; Nadel, 2008; Spreng and Mar, 2012). However, its projections to the limbic and paralimbic structures suggest that it also plays a vital role in emotional processing (Nieuwenhuys et al., 2008). This vital role is reflected by the hippocampal structural abnormalities reported in patients with depression (Sheline et al., 1996; 1999;

Bremner et al., 2000; Videbech and Ravnkilde, 2004; Warner-Schmidt and Duman, 2006) and post-traumatic stress disorder (Bremner, 1999; Smith, 2005; Pitman et al., 2012). Koelsch et al. (2007) also found that individuals with difficulties in producing tender positive feelings, such as happiness, joy and love, displayed reduced activity changes in the anterior hippocampus and amygdala.

#### 2.6.5.1 Dopaminergic neural activity and musical anticipation

Whilst hippocampal activity is associated with the music-evoked tender feelings, dopaminergic neural activity in the ventral striatum has been reported to deal with reward-related emotions such as fun and pleasure (Blood and Zatorre, 2001; Brown, Matinez and Parsons, 2004; Menon and Levitin, 2005; Koelsch et al., 2006). Listening to pleasant music can trigger strong music-evoked pleasure such as “musical frissons” or “chills-down-the-spine”. Salimpoor et al. (2011) proposed that listening to chill-inducing music sequences could induce dopamine release in both the ventral part (the nucleus accumbens) and dorsal part (the caudate) of the striatum. Moreover, the authors noted a temporal dissociation of dopamine release in these structures. In the nucleus accumbens, dopamine was released during the peak emotional experience whereas, in the caudate, dopamine release occurred prior to the onset of such an experience. Therefore, the authors suggested that the nucleus accumbens is more involved in the “liking phase” of musical reward, which signals fulfilled expectations and accurate reward prediction. This fulfilment encourages continuation of this behaviour (i.e. listening to the liked music) via dopaminergic reward. Comparatively, the caudate seems to be involved in the “wanting phase”, suggesting a pleasure-seeking behaviour via the anticipation and prediction of the oncoming reward. The authors further explained how anticipating a series of notes might become pleasurable:

> “A sense of anticipation may arise through one’s familiarity with the rules that underlie musical structure, such that listeners are anticipating the next note that

may violate or confirm their expectations, in turn leading to emotional arousal, or alternatively it may arise through familiarity with a specific piece and knowing that a particularly pleasant section is coming up" (Samplipoor et al., 2011, p.7).

This highlights the suggestion that familiarity with how the content of a musical piece unfolds over time plays a key role in anticipation. It is worth noting that the chill-inducing stimuli used in the experiments by Salimpoor et al. (2011) were provided by the participants themselves. The participants chose these musical sequences from their preferred music and therefore knew the sequences well enough to predict their temporal structures. The influence of predictability on perceived pleasantness of music was investigated by Menon and Levitin (2005), whom also reported reward-related dopaminergic activity during music listening. : In the study, participants listened to excerpts of standard classical pieces, such as Mozart's Eine Kleine Nachtmusik. Each piece had two versions: 1) the normal version and 2) a version with disrupted temporal structure (such as melodic contour and rhythmic groupings). The participants in the study rated the normal versions as pleasant and rewarding and the scrambled versions as slightly better than not at all pleasant. Such results may suggest that musical pleasure and reward is generated by the familiarity of music, which is determined by how predictable the temporal structure, such as the melody and rhythm, of a musical piece can be. This may provide an explanation of why familiar songs are a useful tool in music therapy sessions for patients with dementia (Ridder, 2003; 2005; 2011).

#### 2.6.5.2 Familiar songs and improvisation

Familiar songs can engage different types of long-term memory including semantic memory (ability to identity or hum a song) (Platel et al., 2003) and autobiographical memory (episodic memories triggered by familiar songs from personal past) (Janata, Tomic and Rakowski, 2007). These types of long-term memory, cued by familiar songs and melodies, activate distinct neural networks. Semantic memory is found to activate bilaterally the medial and orbital frontal cortex, the left angular gyrus, and the left anterior middle temporal gyri (Platel et al., 2003). Autobiographical memory is observed in the medial prefrontal cortex as well as the lateral prefrontal and posterior cortices that also track tonality and respond to familiar and autobiographically salient songs (Janata, 2009). One major feature of familiar songs is melodic and rhythmic repetition, which is fundamental to emotional responses (Pereira et al., 2011). In an EEG study, Neuhaus, Knösche and Friederici (2009) found that the musical forms **A**-**A** (adjacent) and **A**-B-**A** (non-adjacent) of a melody could be recognised without time delay due to the recognition of pattern similarity. The authors suggested that in these similar patterns, a rhythmic identity could also be easily recognised on the basis of two or more tones of exactly the same rhythm. This indicates that repetition enables structured music listening and shows humans' ability to detect musical patterns. The repetition of melodic and rhythmic patterns allows musical familiarity, which subserves predictability, to engage auditory attention and elicit emotions such as reward and pleasure. This may explain why musical preferences only marginally activate brain regions such as the limbic, paralimbic and reward system areas, whereas familiarity seems to be the key factor to increasing hemodynamic responses in the emotion-related regions (Pereira et al., 2011). In music therapy, this supports the thesis that familiar songs, such as "Daisy Bell" might be more effective than the perhaps personally preferred Wagner's aria "Liebestod" to engage a client. One could argue that the former may not be age appropriate; however, these deep-rooted songs or rhymes in memory that have short, distinctive and repetitive motifs may attract clients' attention and influence their mood in a more timely fashion during therapy sessions.

Improvisation is another key musical intervention in music therapy sessions. Familiar songs can be used as part of improvisation or vice versa in music therapy. Odell-Miller

(1995) incorporated pre-composed materials such as songs, hymns and Sousa marches into improvisations. These were employed in response to clients' vocalisation or rhythmic pulses, which allowed patients to continue to build on their expressions in music (p.96). Thus, improvisation exemplifies the manipulation of musical elements and properties, including changes in tempo, rhythm, timbre, pitch, harmony and melody. According to Salimpoor et al. (2011), this manipulation may pertain to the enhancement of emotions. They explain that "the emotions induced by music are evoked, among other things, by temporal phenomena, such as expectations, delay, tension, resolution, prediction, surprise and anticipation" (p.261). Therefore, emotional enhancement may explain therapists' use of improvisation to modulate patients' emotions during therapy sessions. It is worth bearing in mind that repetitiveness has been indicated to be a key factor in aesthetic responses to unfamiliar music (Margulis, 2013). Accordingly, therapists may need to improvise music in a more structured style in order to enable the potential impact of anticipation on clients' attention, mood and behaviours.

The above has outlined the feelings of musical reward in accord with the sense of anticipation and dopaminergic activity in the mesocorticolimbic system. It is necessary to note that this system covers a wide network of brain regions. In addition to the ventral tegmental area (VTA), striatum and ventral pallidum, other regions, such as hypothalamus (Menon and Levitin, 2005), insula, orbitofrontal cortex (OFC) and anterior cingulate cortex (ACC) (Kelley and Berridge, 2002; Wise, 2004; Haber and Knutson, 2010), are also part of this system. Some of these regions have other functions beyond emotional processing. The ACC, for example, is in a unique position involved in the synchronisation of cognition, monitoring processes, movement-related functions, motivation, (Koelsch, 2013, p.296) and physiological arousal as part of autonomic nervous activity (Critchley et al., 2000; Critchley et al., 2003; Luu and Posner, 2003;

Critchley, 2005; Craig, 2009). An EEG study by Sammler et al. (2007) found increased theta rhythm at the midline of the frontal area in response to pleasant music. This may reflect the activation of the dorsal ACC, which pertains to the attentional processes linked to emotional processing. Moreover, increased frontal midline theta power due to sustained attention has been reported to correlate with cardiac autonomic activities during meditation as an approach to emotion regulation (Kubota et al., 2001; Takahashi et al., 2005). The aforementioned "musical frissons" were manifested by several "physiological or emotional arousal" indicators, including increases in heart rate and skin conductance and decreases in skin temperature and blood volume pulse amplitude (Salimpoor et al., 2011).

These findings again underline the power of music in influencing autonomic nervous activity. Therefore, the use of music fits into the aforesaid neurovisceral integration theory (Thayer and Lane, 2000; 2009) and polyvagal theory (Porges, 2001; 2009a; 2009b; 2010; 2011) which pertain to the regulation of physiological arousal, cognition and, particularly, emotion. With this notion in mind, music elements (e.g. melody and rhythm) or properties (e.g. timbre and pitch) would, undoubtedly, deserve further understanding in order for music therapists to utilise them to modulate heart rate, respiration, movements and mood to achieve certain regulative goals. The following section will discuss the neurophysiological mechanisms of these building blocks of music.

#### 2.6.5.3 Pitch

Pitch is a fundamental property of music that can be used to construct intervals, melodies, chords and harmonies. The secondary auditory cortex (the lateral area of the primary auditory cortex in Heschl's gyrus) has been suggested as a pitch centre to encode the percept of pitch (Penagos et al., 2004). By examining consonant and dissonant pitch relationships, Bidelman and Krishnan (2009) found that the brainstem was responsible for mediating pitch processing of harmonic tones, i.e. two-note intervals such as perfect 5th and minor 2nd, played simultaneously. Additionally, the authors found behavioural preference of encoding consonant pitch relationships and inferred that this basic encoding preference was rooted in low-level sensory processing. Encoding melody, a sequence of changes in pitch, is another human innate ability. This ability enables the appreciation of melodic contour, the ups and downs of pitch patterns, even when the melodies are unfamiliar (Trainor and Trehub, 1992; 1994). Lee et al. (2011) found that discriminating between the upwards and downwards contours of unfamiliar short melodic sequences (5 notes) activated the region of the right superior temporal gyrus (rSTS), left inferior parietal lobule (lIPL) and anterior cingulate cortex (ACC). It is interesting to note that the authors also found activation in the supplementary motor area (SMA) alongside a part of the ACC. As previously discussed, the ACC is also involved in emotion, attention, motivation and behaviour-monitoring. Therefore, the authors suggested that the SMA and ACC activity had certain affective implications, associated with perception-action coupling. This indicated that simply listening to ascending and descending unfamiliar melodies, such as what music therapists would improvise in therapy sessions, could generate affective and sensorimotor responses in patients. Moreover, Koelsch and Jentschke (2010) used EEG to probe the time course of melodic and harmonic processing. Their results showed that unfamiliar short melodies with irregular endings (an unexpected and music-syntactically irregular note) activated earlier frontal brain activity than the same melodies used as the top voices within chord sequences. In the context of music therapy, this may suggest that therapists' improvised melodic sequences, though unfamiliar to patients, may still generate attentional responses more quickly than harmonic sequences.

When it comes to familiar melodies, activity in the rostral regions of the superior temporal gyrus was found when listening to, imagining and judging the familiarity of musical stimuli (Platel et al, 2003; Herholz, Halpern and Zatorre, 2012). Bella, Perez and Aronoff (2003) found that it only took 3 to 6 notes in about 2 seconds to generate the feeling of knowing a familiar melody in the experimental participants. Most importantly, the motif structures were found to impact on the time course of melody recognition. Adding to this finding, Filipic, Tillmann and Bigand (2010) found that a shorter time was required (approximately 500 milliseconds) for generating such a feeling of familiarity when CD recordings of classical instrumental music were used instead of the single line piano melodies used by Bella, Perez and Aronoff (2003). Additionally, the authors found that eliciting emotional judgements of such short musical excerpts only required half of the time (approximately 250 milliseconds) needed for familiarity judgements. Interestingly, the authors ascribed this fast-acting emotional process to the low-dynamic excerpts which contained fewer notes and less rhythmic patterns. They interpreted that musical excerpts containing high-quantity and rapidly occurring events could delay the extraction of relevant information such as timbre and expression. Higher arousal evoked by the complex musical information could also require additional processing time. Therefore, low-dynamic excerpts allowed attention to focus on relevant information more easily, which led to faster extraction. Such findings again help explain why during music therapy sessions, familiar songs with a short and simple motive may be more effective than personally preferred or age-appropriate pop songs or opera arias to timely elicit attentional and emotional responses in pivotal therapeutic moments. The same notion may also apply in improvisations; an improvised musical sequence with complex harmonic and melodic events and less defined motif boundaries might not effectively catch a patient's attention and elicit emotions. Therefore, therapists may need to employ more structured improvisation with a reduced texture in order to help patients attend to targeted musical information, leading to certain therapeutic goals such as arousal regulation. This may echo Ridder's

(2011) insights into facilitating social engagement with patients with dementia in music therapy:

> "To facilitate regulation, the therapist chooses improvisations or well-known, but not personally meaningful, songs. The improvisations should be repetitive to signal form and structure, which in turn assists the client to orientate and focus" (Ridder, 2011, p. 138)

These observations may become particularly helpful when working with a clinical population whose deteriorating cognition impedes their ability to fully perceive and comprehend musical information.

#### 2.6.5.4 Timbre

Timbre is what humans use to discern various sounds, such as the identities of musical instruments or human voices as well as natural and unnatural sounds. Two major physical spectrotemporal characteristics are usually used to determine timbral representations. One is "attack and decay" which describes the slope of the increase (attack) and decrease (decay) in energy that follows the onset of a sound. The other is "spectral centroid", often referred to as brightness of a sound, which is the centre of the mass along the frequency spectrum (Grey, 1977; Grey and Gordon, 1978; McAdams et al. 1995; McAdams, 1999, Schubert, Wolfe and Tarnopolsky, 2004). Brain regions such as the posterior superior-temporal lobes and the right superior temporal sulcus are found to respond to the variation of timbre and the analysis of the voices of musical instruments (Menon et al., 2002, Belin et al., 2004; Warren et al., 2005). Timbre has been found to influence emotional judgements of music (Gabrielsson & Juslin, 1996; Juslin, 1997; Balkwill and Thompson, 1999; Hailstone et al, 2009). Hailstone et al. (2009) found an interaction between the instrumental identity (timbre) and perceived emotions. For example, "happy" melodies were less identifiable as "happy" when played on a violin than when played on other instruments including a piano, trumpet or synthesizer. “Sad” melodies were less identifiable when played by a synthesiser. Instead of investigating the instrument identity, van der Zwaag (2010) examined the relationships between psychophysiological responses and the percussiveness of musical sounds (i.e. a cello that is plucked with the fingers or the “sharpness” of sound). The authors found that high-percussive music elicited higher arousal, demonstrated by increased skin conductance levels and responses. Such psychophysiological responses demonstrated by skin conductance are associated with increased attention and emotional experience (Critchley et al., 2000). Therefore, the authors suggested that percussiveness was an important factor in modulating emotions, as it might strengthen the influence of other factors, such as major mode and fast tempo, on the intensity of positive feelings as shown in their results. Another study (Gomez and Danuser, 2007) also found that *staccato* was one of the elements of music that induced faster breathing, higher minute ventilation, skin conductance and heart rate. These insights underscore the use of timbre in modulating emotions and physiological arousal, which may serve as an effective clinical notion in music therapy. Perhaps similarly, such notion may be transferrable to the use of vocal timbre when singing well-known songs or improvising vocalisations. Legato, soft and breathy vocal quality of singing may induce perceptual and physiological responses that differ from the ones induced by a bright vocal sound or vibrato. Accordingly, music therapists may not only need to attend to what tunes they choose to play or sing, but also how they articulate the contours of the tunes with a suitable timbre. Above all, this may shed light on the benefit of live musical making in music therapy, as timbre is a property of music that can be flexibly adjusted on the spot to catch patients’ attention and modulate their emotions.

#### 2.6.5.5 Temporal structure

The patterns of musical events in time are another adjustable element in live music making that can motivate human movements such as, dancing, foot tapping and hand clapping. The use of *accelerando*, *a tempo* and *ritenuto* may influence how these physical movements are performed. These temporal patterns are created through variation in the onsets and durations of notes in a melody or sequence of sounds without a pitch percept. Rhythm, accent and metre are usually the major components to construct temporal patterns. A rhythm is made of intervals that are integer ratios of one another. For example, a rythm can contain intervals of 250, 500, and 1000 milliseconds. These three intervals are in 1:2:4 ratios which are integer. In contrast to this, 1.4: 2:4.5 are not integer ratios. Also, within a rhythm, there are accents occurring at regular intervals which induce the perception of a regular beat. Regular beats, marking a rhythmic sequence, then give rise to sense of a metre.

When listening to beat-based rhythms, brain activity has been observed in the cortical motor regions such as the supplementary motor area (SMA) and premotor cortex (PMC) and subcortical regions such as the basal ganglia and cerebellum (Schubotz and von Cramon, 2001; Mayville et al., 2002; Ullén, Forssberg and Ehrsson, 2003; Lewis et al., 2004; Grahn and Brett, 2007; Chen, Penhune and Zatorre, 2008; Bengtsson et al., 2009). The basal ganglia and cerebellum have respective functional roles in the perception of temporal patterns. The basal ganglia are believed to be involved in beat perception and detection. Therefore, degeneration in the basal ganglia as manifested in patients with Parkinson's disease has been linked to deficits in discriminating changes of beat-based rhythms (Grahn and Brett, 2009). In contrast, the cerebellum is more involved in the perception of absolute time intervals rather than beats (Grube et al., 2010a; 2010b). It is necessary to note that accents are a critical cue to identification of a beat, as perceived accents are used to determine the beat in a sequence (Drake and Botte, 1993; Toiviainen and Snyder, 2003; Hannon et al., 2004). The perception of beat in music can be also influenced by different types of accent, whether these are the manipulations of volume, duration, timbre and so on. When synchronising to rhythms by tapping, increased volume accents were reported to generate greater connectivity between the PMC and auditory cortex (Chen, Zatorre and Penhune, 2006). This suggests that accentuation by increasing the volume of certain notes may be of use in music therapy to facilitate patients' motor responses such as entrainment.

Entrainment is a unique phenomenon and ability limited to animal species such as human and parrots, which are capable of vocal learning and mimicry (Patel et al., 2009; Schachner et al., 2009). Entrainment is induced when rhythmic structure and tempo of auditory inputs synchronise with brain activity and heart rate (Juslin, Liljeström and Västfjäll. 2011). Movements have been reported to be facilitated by entrainment arising from regular metrical structure (Grahn and Brett, 2007; Tierney and Krauss, 2013). Entrained movements have also been described as *musical groove*, which is defined as the urge to move in response to music (Janata, Tomic and Haberman, 2012; Stupacher et al., 2013). Bass and percussion instruments are often used to induce such an urge (Iyer, 2002). However, a repetitive rhythm is the key to shaping the feeling of a groove, by enhancing the ability to predict and synchronise with a beat (Madison et al., 2011). Accurate movement synchrony and spontaneous foot tapping has been observed during listening to high-groove music such as "Superstition" by Stevie Wonder (4/4 metre and 101 beat per minute). This type of music engages the motor system, modulates corticospinal excitability (Stupacher et al, 2013) and may reinforce a sense of pleasure (Janata, Tomic and Haberman, 2012). Therefore, entrainment appears to go beyond auditory-motor coupling to involve emotion evocation (Juslin, Liljeström and Västfjäll. 2011; Trost and Vuilleumier, 2013) and cognitive processes, such as attention (Jones and Boltz, 1989; Bolger, Trost and Schön, 2013). The study by Bolger, Trost and Schön

(2013) showed that auditory rhythmic entrainment facilitated the directing of attention to visual targets. Taken together, it implies that entrainment observed in music therapy sessions may be an indicator of patients' levels of cognitive, emotional and sensorimotor functions. Music therapists may therefore be able to utilise musical metres and beats to probe if patients' retain the ability to integrate sensory inputs and motor outputs. Over time, this observation in therapy sessions may serve as an additional reference to the rate of deterioration, which may contribute to the adjustments to care planning and delivery. Additionally, if sensorimotor connectivity is observed in sessions, it would suggest the activation of the auditory attention allocated to rhythmic patterns. Consequently, music therapists may be able to identify the type of music cues that remain effective for a patient, in order to direct a patient's attention and modulate their emotion. This observation, again, may offer practical methods for care staff in managing neuropsychiatric symptoms such as agitation or apathy.

## 2.7 Emotion regulation

Up to now, the current chapter has surveyed the emerging evidence of how the facial, bodily, vocal and musical expressions communicate emotions within neuro-anatomical and behavioural paradigms. The understanding of the mechanistic functions of such emotional expressions may offer an understanding of *what* humans use to signal their emotions and *why* they use these emotional signals in certain ways within the social context. Such an understanding is of use when examining the perceptual inputs and action outputs of these communicative signals between therapists and patients in music therapy. Following on from this, the following section will connect the aforementioned insights in order to address *how* the aforesaid signals can be used to modulate emotions.

As mentioned earlier, dementia care home residents' quality of life is greatly impacted by their mood in terms of depression, anxiety and agitation (Hoe et al. 2006; Beerens et al., 2013). This makes emotion regulation a critical task in the context of both therapy and daily care. Emotion regulation is a core aspect of cognitive and behavioural therapies (Phan and Sripada 2013, p. 396) and a growing area for research in the field of affective neuroscience. Considering that neuropsychiatric symptoms may arise from the degeneration of the brain circuitry of emotional processing, including the parietal and prefrontal association cortices, cingulate gyrus, fusiform gyrus and insula (Wright, 2011, p. 425), modulating emotions such as anger or sadness may be understandably crucial to manage such symptoms. It is necessary to note that the process and strategies of emotion regulation involve the use of cognitive functions such as attention and memory as well as sensorimotor functions. For patients with declining cognition, their retained functioning would play a critical role in the success of emotion regulation. This would underline the need for music therapists to acquire knowledge of the accessible cognitive and sensorimotor functions in each individual patient. Most importantly, emotion regulation can not only be implemented in therapy but also in patients' daily life. Therefore, communication between music therapists and care staff may enable better care planning and delivery that incorporates strategies of emotion regulation to enhance patients' wellbeing.

Before discussing emotion regulation, it is worth noting that an emotion can be seen as a transition from a perception and appraisal phase to a response phase. Emotions, when triggered, can generate changes across multiple cognitive and physiological systems and specific action tendencies (Phan and Sripada 2013, p. 376). Accordingly, the success of regulation can be evidenced by subjective ratings of self-awareness and measured changes in the peripheral nervous system, i.e. heart rate and skin conductance and central nervous system (Adolphs, 2002; Phan et al, 2003; Fusar-Poli et al., 2009). The process of emotion regulation therefore follows this emotion-generative process, which delineates how an emotion unfolds over time and implicates certain strategies that can be used to modulate the emotion. The process model proposed by Gross and colleagues

(Gross 1998, 1999, 2002; Gross and Thompson 2007) is often used to address this process, which consists of 4 cyclical stages: situation selection/modification, attentional deployment, cognitive change and response modulation. The first 3 stages are antecedent-focused, which arise before the occurrence of behavioural responses in relation to an emergent emotion. The last stage occurs after the resulting behavioural and emotional responses and therefore is response-focused (Frijda, 1986; Gross, 1998).

### 2.7.1 Situation selection and modification

In this initial perception and appraisal stage, a person will first take actions to choose or avoid a situation that will lead to desired or undesired emotions. Secondly, a person will try to modify a situation in order to decrease any emotional impact (Scherer, 1984; Smith and Ellsworth, 1985; Lazarus, 1991; Gross, 1998). Understandably, cognitive deficits due to dementia would impede this decision-making or evaluating process. For example, a care home resident with dementia may not be cognitively able to avoid going into a lounge where the high volume from the TV could trigger agitation. As agitation appears, the resident may not able to understand that removing herself from the noisy environment or turning down the volume would reduce her level of agitation. This clearly highlights that care home residents with dementia are dependent on care home staff to help determine the cause and prevent the resultant agitation. It may further stress the need for care home staff to minimise environmental overload by carefully controlling environmental stimuli such as lighting, temperature and noise. Music therapists may therefore be able to advise the tolerance levels observed within therapy sessions.

### 2.7.2 Attentional deployment

Attention is one of the most important constructs of cognition during the appraisal phase of an incited emotion. Directing attention towards or away from an emotionally provocative stimulus could lessen the emotional impact. Distraction is a key strategy within this respect. This should modulate the activation of brain regions such as the amygdala, ventral stratum, nucleus accumbens, insula and ventral prefrontal cortex and orbital frontal cortex (Phan and Sripada, 2013). These areas are generally thought to be responsible for emotional appraisal, generation and responding. As discussed earlier, brain activity and emotional arousal could be influenced by facial expressions, particularly eye-contact (George, Driver and Dolan, 2001; Conty et al., 2010). Accordingly, a therapist may need to cautiously employ such emotional signals that could intensify anger or agitation that is already being displayed by a patient in a therapy session. In such a situation, avoiding direct eye contact and directing the patient's attention away from the therapist's facial expressions may reduce the patients' agitation. This may be explained by studies reporting less amygdalar emotional reactivity at the allocation of attention to non-emotional features of emotional faces (Fusar-Poli et al., 2009).

Another form of attention distracting strategy is the use of self-generated autobiographical memories (Cooney et al., 2007). This may be applied in therapy sessions with a patient who is displaying symptoms such as anxiety, disorientation or low mood. A therapist could engage a patient in allocating attention to retrieving positive personal memories that are incongruent with current negative emotional state. The activation of the ventrolateral prefrontal cortext and orbitofrontal cortex within the neural circuitry regulating mood and anxiety has been reported during this mood-incongruent recall (Cooney et al., 2007). Clients with dementia who may have difficulties in self-generating long term memories would require therapists' assistance to initiate cues for recall. If verbal cues fail to achieve this goal, music may be used as a potent cue to evoke relevant autobiographical memories. Songs from one's past have been reported to generate strongly felt positive emotions as well as other emotions such as nostalgia, associated with the social and situational contexts of memories (Janata, Tomic and Rakowski, 2007). In order to utilise autobiographical memories as an emotion regulation technique, it may necessitate a great deal of knowledge of a patient's personal history. This again highlights the needs for therapists and carers to mutually share and feedback such relevant information.

Distraction may be useful in the early stage of emotion regulation. However, the success of implementing this strategy may also depend on the understanding of how the attention of a client with dementia is deployed. Therapists may need to acquire the knowledge and skills of identifying components of attention such as alerting, orienting and executive control (Posner and Boies 1971; Posner and Petersen 1990) and types of attention including focused, sustained, selective, alternating and divided attention (Sohlberg and Mateer, 1989). Consequently, therapists may be able to advise which musical, verbal or nonverbal stimuli could activate or distract a patient's various attentional processes. These stimuli then may be used to devise effective distracting strategies that can be implemented in daily caregiving.

### 2.7.3 Cognitive change

This stage focuses on modifying the evaluation of the situation in order to change its meaning and emotional significance (Phan and Sripada 2013, p.378). Reappraisal is the key concept during this process, which is to reframe the meaning of an aversive situation from a negative interpretation to a positive one (Phan and Sripada, 2013, p.383). Reappraisal has been found to reduce negative affect and attenuate the activation of the amydala and medial orbitofrontal cortex. At the same time, it increases the activation in the dorsolateral, ventrolateral and dorsal medial regions of the prefrontal cortex (Ochsner et al., 2002). Interestingly, the medial prefrontal cortex (MPFC) has also been reported to have a key role not only in retrieving autobiographical memory (Cabeza, 2004) but also self-referential information that involves semantic memory (Johnson et al., 2002; Kelley et al., 2002; D'Argembeau and Salmon, 2012). This self-referential information is composed of personal attributes including skills, preferences and characteristics. Sentences such as “I am a confident person”, “I know this song, I like it”, “I can play piano” or “I am a father and I have two children” are the epitome of such information that manifests semantic form of self-knowledge. Therefore, the recruitment of activity in the MPFC by using personal facts may be part of reappraisal to help modulate emotions. This may be applied in music therapy with a care home resident when she is disorientated in time and space and is displaying emergent anxiety. Engaging the resident in recalling certain facts about herself, such as her children and their names or things she likes may be reassuringly helpful. This may enable the re-interpretation of her current reality to reduce anxiety due to possible increases in the MPFC activity. It is noteworthy that this strategy relies on therapists’ knowledge of a patient’s personal history as well as cognitive processing. Reappraisal engages components of cognitive process, such as working memory, action monitoring, response inhibition and reversal learning (Phan and Sripada, 2013, p. 385). Therefore, this strategy would only be effective for patients who retain some of these cognitive aspects. In the above care home resident’s scenario, semantic memory, a long term memory of facts and events, was still accessible to help offset the uprising anxiety.

### 2.7.4 Response modulation

The last stage in the process of emotion regulation is response modulation. It focuses on changing the reaction after an emotion or behaviour has been fully generated (Phan and Sripada, 2013). Suppression is a technique that can be demonstrated by asking people to keep their face still in order to supress the emotions generated by negative or aversive film clips (Goldin et al., 2008). Suppression has been found to have little influence on subjective negative emotion (Gross and Levenson, 1997). Overall, this response-focused strategy is thought to be a less effective than antecedent-focused strategy as antecedent-focused strategy tends to alter the trajectory of an emotion early in the emotion-generative process (Gross and John, 2003). However, it should be noted that response modulation involves directly altering internal physiological responses such as heart rate (Phan and Sripada, 2013, p. 378). This may offer music a unique and highly versatile role in helping implement this strategy. As previously discussed, music can be broken down into elements such as melody and rhythm. When manipulated, they have been reported to influence heart rate, skin conductance and respiration which are associated with emotions related to reward and motivation  (Blood and Zatorre, 2001; Peretz and Zatorre, 2005; Coutinho and Cangelosi, 2011; Dellacherie et al., 2011, Salimpoor at el., 2011; Chanda and Levitin, 2013; van den Bosch, Salimpoor and Zatorre, 2013). This may underpin music therapy sessions where improvisation between a therapist and patient is a demonstration of flexible adjustment of music elements that can timely regulate physiological arousal in order to modulate emotional responses. Morever, familiar songs or pre-composed music may also serve the same purpose (Pereira et al., 2011; van den Bosch, Salimpoor and Zatorre 2013). Van den Bosch, Salimpoor and Zatorre (2013) relate to a bottom-up (often accompanied by physiological changes) and a top-down (a slower cognitive evaluative process) to offer some possible explanations why music could mediate emotional processing:

> "In the musical domain, automatic implicit appraisal is a bottom-up process, largely related to the intrinsic structural aspects of the music itself, whereas explicit appraisal is a top-down, conscious evaluation process involving individual variables such as personal preference, motivation, past listening experiences, social attitude, etc" (van den Bosch, Salimpoor and Zatorre, 2013, p.8).

The above indications highlight the role of musical structure within familiar songs or improvisation in up-regulating emotions through directly altering physiological arousal.

In addition, if patients are still able to access remote memory, a personal meaningful song may help retrieve positive memories to cognitively down-regulate emotions.

## 2.8 Summary

The above discussion provides a brief overview in order to demarcate the principles involved in the process of emotion regulation. Several mental disorders, including depression, anxiety, personality and eating disorders, have been associated with difficulties in regulating emotions (Aldao, Nolen-Hoeksema and Schweizer 2010). There has also been evidence to support the incorporation of emotion regulation interventions in clinical care settings in order to improve physical health and psychosocial wellbeing (Smyth and Arigo 2009).

Neuropsychiatric symptoms, such as depression, anxiety, agitation and apathy, are a major challenge in dementia care homes. Moreover, care home residents' moods have been indicated to have a major impact on quality of life. Therefore, emotion regulation may offer a theoretical foundation for implementing music therapy in dementia care homes. In music therapy sessions, emotion regulation pertains to the use of the aforesaid components: talking, singing familiar songs, joint improvisation and therapists' vocal, facial and bodily expressions. Each of these components may derive from different neural, behavioural, emotional and cognitive mechanisms. Therefore, therapists may not only need to employ these visual and auditory stimuli intuitively and flexibly but also structurally and strategically, based on the research findings of relevant disciplines, such as affective neuroscience.

Moreover, as emotion regulation strategies can be implemented both in music therapy and daily caregiving, sharing information to help identify and evaluate these strategies should become the central point in post-therapy communication between music therapists and carers. As discussed earlier, training staff how to interact with residents with dementia has demonstrated long term effects on the management of symptoms. Post-therapy communication may, therefore, have a pivotal role within this respect. Although active staff involvement is the key to successfully implementing psychosocial interventions in care homes, individual music therapy, which is perceived as an intervention behind closed doors, can pose challenges in involving staff. Using video excerpts from music therapy sessions may be an effective method to involve staff in music therapist-carer communication. Therefore, post-therapy video presentations to staff may need to be incorporated into the protocol of individual music therapy sessions. The feasibility and the potential effects of these presentations would need to be tested.

# Chapter 3 Methods

## 3.1 Introduction

This chapter discusses how the current study was carried out through a cluster randomised controlled feasibility study, followed by two in-depth case studies. Prior to detailing the respective designs, methods and procedures involved in the feasibility and case studies, the chapter will present the rationale behind the chosen methods based on the methodological considerations, research questions and overall study design.

## 3.2 Methodological considerations

Most existing music therapy studies in dementia care (see section 2.5 in Chapter 2) have adopted the technique of Randomised Controlled Trials (RCTs) to evaluate the effects of this intervention on Neuropsychiatric Symptoms of dementia (NPS). This quantitative method is a gold standard in evaluating health care interventions and is based on deductive reasoning, which is philosophically underpinned by positivism and post-positivism. These two philosophical positions concern aspects such as operational definitions, objectivity, replicability, causal relationship, hypothesis testing, validity and reliability (Bryman, 1984; Philips and Burbules, 2000). Although these aspects can be seen as the strengths of scientific research, authors such as Onwuegbuzie (2000), Johnson and Onwuegbuzie (2004) and Morrison, Cohen and Manion (2007) have identified the weaknesses of this methodology. In addressing these weaknesses, Johnson and Onwuegbuzie (2004) argued that the "knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals" (p.19). This argument highlights the disadvantage of using RCTs, which may fail to derive knowledge regarding how research findings can be applied in improving individuals' health. Perhaps due to this weakness, the Medical Research Council (MRC) guidance for developing and evaluating complex interventions (Craig et al. 2008) recommends the use of qualitative methods to support RCTs. Qualitative methods are underpinned by constructivism (Creswell, 2003), based on the assumptions that individuals make sense of subjective meanings through their interpretation and experiences of interacting with a human community (Crotty, 1998). Therefore, qualitative research may help develop a better understanding of how interventions work (Orrell, 2012). Moreover, the use of both quantitative and qualitative work suggests a mixed-methods approach, which is supported by the philosophy of pragmatism (Rorty, 1990; Cherryholms, 1992). This position focuses on “what works” and “solutions to problems” (Creswell, 2003). Therefore, it places an emphasis on research questions instead of the paradigm that underlies the method and employs pluralistic approaches to obtain knowledge about the problems (Patton, 1990; Tashakkori & Teddlie, 1998; 2003). It is important to establish a rationale for mixing quantitative and qualitative methods in a research design (Creswell, 2003). Once again, this underlines the precedence of research questions in weighing up and justifying multiple approaches used in data collection and analysis.

## 3.3 Research Questions

Based on the previous survey of evidence in Chapter 2, it has become apparent that individual music therapy is still at an early stage of development. In addition, the development of this intervention for management of NPS in care homes would need to consider the role of staff delivery of daily care, which may have a greater and longer impact on these symptoms (de Vugt et al., 2004; Sink et al., 2006). Therefore, it is necessary to explore how music therapy can enhance caregiving in daily life in addition to alleviating symptoms during therapy sessions. This notion enabled the formulation of the main research question:

1) Can individual music therapy be an acceptable and practicable intervention in care homes that potentially improves residents' neuropsychiatric symptoms of dementia and their carers' management of these symptoms?

This question may merit from quantitative observations to assess the change and management of symptoms over time, which can be operationally defined in terms of frequency and severity (Cummings et al., 1994). Additionally, how the recipients respond to the intervention in terms of acceptability and practicability may also be qualitatively explored by probing the recipients' experiences of the intervention. Therefore two sub-questions were identified to further explore the mechanisms of the intervention:

2) How might individual music therapy help carers manage the symptoms?
3) How might the intervention generate a change in residents' symptoms?

Answering this sub-question will help identify the active components of the intervention and obtain an understanding of how these components interact to produce effects on residents' symptoms and carers' delivery of care. This sub-question may seem to require a dominant qualitative method for delving into the meanings of the intervention to residents. Some studies have suggested that people with significant cognitive impairment can still express their views in a meaningful way in interviews (Mozley et al., 1999; Byrne-Davis, Bennett and Wilcock, 2006). However, Hubbard, Downs and Tester (2003) and Beuscher and Grando (2009) noted challenges, such as verbal communication impairment, emotion disposition and the trustworthiness of data when interviewing people with dementia in research. The usefulness of this technique may be further restricted if participants display no speech production and limited verbal comprehension. Additionally, it may require health professionals' theoretical and clinical knowledge to interpret how the effects of the intervention are generated on health in terms of neuropsychological nomenclature (see section 2.3.2 in Chapter 2).

Therefore, video observation may allow for the interpretation of health benefits through the lens of science. The use of video recordings has been suggested to be an effective way of studying the behaviours and experiences of people with dementia (Cook, 2002). This method has previously been applied in doctorate research by Ridder (2003), who incorporated both qualitative and quantitative observations into in-depth case studies in order to explore the communicative responses of persons with dementia during therapy sessions.

Having formulated the above research questions and reasoned the advantages of mixing different methods in seeking answers, this chapter will now discuss the details of the methods used in line with the study design.

## 3.4 Study design

The purpose of this study was to develop individual music therapy in dementia care homes. Two phases were involved in the research process. The first phase was to test the feasibility of implementing this intervention in care homes in order to address the first and second research questions. To address the third research question, the second phase explored how the intervention worked to generate beneficial effects on residents' health during the feasibility testing. These two phases were carried out under an overarching mixed-methods design. However, each phase had its respective type of mixed-methods design, either qualitative or quantitative dominant.

**Phase One**: A cluster randomised controlled feasibility study, including semi-structured interviews with care staff, was designed to test the procedure and safety of the intervention and to estimate recruitment and retention. Feasibility studies, which are sometimes referred to as "proof of concept", "vanguard studies" or "pre-studies", have noted importance in guiding the planning of a large-scale study. Although a feasibility study may provide preliminary evaluation of the outcome of interest, its main concern is to explore aspects, such as the mechanisms of treatment, participants' willingness to be recruited and randomised, and response and follow-up rates (Arain et al., 2010; Thabane et al., 2010).

The use of cluster randomisation has been suggested as a solution to the contamination of the control group in individually randomised trials (Craig et al., 2008). The risk of contamination becomes possible when "the treatment given to control individuals will be affected by an organisation's or professional's experience of applying the intervention to other patients in the experimental group" (Eccles et al., 2003, p.48). This contamination effect has been noted as a drawback of randomising individuals instead of clusters of individuals, leading to biased estimates of effect size (Craig et al., 2008). Therefore, the current study recruited participants from two care homes and randomised these participants according to the unit on which they lived within the home. In each home, one unit was randomly allocated to the intervention group and the other to the control group. This enabled both units in each home to receive unanimous quality of standard care and input of general activities. The intervention units received weekly individual music therapy for the five month period.

As a mixed methods design, participants' levels of well-being and presentation of dementia symptoms were assessed with outcome measures at Baseline, Month 3, Month 5, and as a follow-up at Month 7. Staff perceptions of music therapy were explored through semi-structured interviews at Month 6. This mixed-methods design has been identified as a concurrent embedded design, where a secondary form of data (i.e. qualitative) is embedded in a larger primary form of data (i.e. quantitative) to provide supportive information (Creswell & Plano Clark, 2007, Creswell, 2009). This approach of embedding means that the primary quantitative strand addresses the outcomes of the treatment whereas the secondary qualitative strand explores the participants' experiences during the process of treatment. Each of the two strands brings a different picture to build an overall view towards the problem.

**Phase Two**: A case study design was identified in order to explore the mechanism of individual music therapy sessions and to complement the previous phase, which addressed the feasibility of the intervention. Case study designs are often used to answer "how" and "why" questions (Yin, 2003). This approach allows for in-depth analysis of a single case or multiple cases through the use of resources such as documents, archival records, interviews, observations, physical artefacts and audio-visual materials (Creswell, 1998; Williams, 2011). The case study design used in this research employed a sequential explanatory mixed-methods approach, which is "characterized by the collection and analysis of quantitative data in a first phase of research followed by the collection and analysis of qualitative data in a second phase that builds on the results of the initial quantitative results" (Creswell, 2009, p.211). To translate this into the current case study, quantitative heart rate data was collected and analysed to investigate how two care home residents' heart rate changed in response to the therapist's inputs during individual therapy sessions. Subsequently, qualitative video observation of the therapist and residents' behaviours was used to help explain the change of heart rate. Comparing these two individual cases served the purpose of this phase in establishing an understanding of how the therapist generated the potential therapeutic effects during therapy sessions. This in turn refined the formation of theory based on emotion regulation as discussed in the Chapter 2 Literature Review.

Following on from the above discussion of the study design, this chapter will now detail the respective methods and procedures of data collection and analysis in the cluster randomised controlled feasibility trial and case study.

## 3.5 Procedure: Phase One- Cluster randomised controlled feasibility study

### 3.5.1 Setting

**Methodist Homes (MHA)**

MHA, a charitable care organisation supporting older adults, was founded by members of Methodist Church in 1943 in the UK. Today it provides care, accommodation and support services for more than 16,000 older people throughout Britain. Inspired by Christian concern, the charity's mission is to improve the quality of life of older people. In 2008, a music therapy programme was piloted and incorporated into the dementia care service provided in the charity's care homes. The programme is currently running in 54 dementia care homes. Residents receive weekly music therapy by 18 music therapists employed by the charity. The current study is funded by the charity in collaboration with Anglia Ruskin University.

**Care homes**

The study took place at two MHA care homes: Home 1 and Home 2. Both cater for people with varying levels of need including residential, dementia or nursing care.

The homes were chosen according to their practical suitability for the project. Two units in each home were required to operate relatively independently of each other, in order for the control and intervention groups to be kept separate from each other. This helped prevent residents in the control group being influenced by staff perceptions and actions in the music therapy group. In both homes, the units comprised en-suite bedrooms for each resident, a communal lounge and dining area, and at least one quiet room. In Home 1, there was accommodation for a total of 60 residents across 4 units: (15 beds and 3 staff in each); the two units used in the project were both located on the ground floor but at opposite ends of the building (15 beds and 3 carers; 15 beds and 3 carers). Home 2 provided accommodation for 68 residents across three floors: ground (20 beds, 4 carers), 1st (24 beds, 5 carers) and 2nd (24 beds, 6 carers).

### 3.5.2 Participants

**Resident participants**

Residents were recruited according to the following inclusion criteria:

They should:

- Reside within one of the units identified for the project
- Have a diagnosis of dementia
- Display at least two neuropsychiatric symptoms of dementia
- Be at least 40 years of age
- Display no significant health problems

Residents were recruited from the homes' pool of music therapy referrals. This pool consisted of residents referred by staff or relatives, generally due to the presence of neuropsychiatric symptoms of dementia. Residents were assessed for eligibility according to the inclusion criteria. Residents who did not meet the inclusion criteria were put on a waiting list to receive music therapy at a later date. Informed consent was obtained on behalf of all residents, through their next of kin. Participants were allocated to either the intervention or control group, depending on which unit they resided in. Residents' demographic and medication information was collected once recruited. Their Global Deterioration Scale scores (GDS) (Reisberg et al., 1982) were calculated by the researchers following discussion with residents' keyworkers.

**Care staff participants**

Staff participants were recruited according to the following criteria:

They should:

- Work as a care assistant within one of the units identified for the project
- Have at least 3 months' experience of working with the resident participants
- Be able to regularly work on the weekday that music therapy is provided

The research team initially sampled care staff by giving presentations on the units about the project. Staff who exhibited an interest in taking part were reviewed with regards to the eligibility criteria. Those who fulfilled the criteria and wished to take part provided consent.

**Ethics**

The study design was developed in consultation with academic and health professionals. Ethical approval was reviewed and granted by the National Research Ethics Service (see Appendix 1), and through Anglia Ruskin University Ethics Committees, in February 2013. The trial was registered with ClinicalTrials.gov with the registration number NCT01744600.

### 3.5.3 Intervention

**Music therapy**

Resident participants in the intervention group received 1:1 active music therapy once a week, in addition to standard care, for a period of 5 months. Each 30-minute session was conducted by one music therapist in a quiet room on the unit, and was video-recorded. Two qualified music therapists worked on the project; both had at least 2 years' experience working in this setting and were registered with the Health and Care Professions Council (HCPC). To provide consistency and to maintain the therapeutic relationship, residents received sessions from the same music therapist throughout the project. The sessions were based on the live interactive music therapy methods akin to the work of Odell-Miller (1995; 1997; 2002) and Ridder (2011; 2013). In addition, affective neuroscience (Panksepp, 1991; Armony and Vuilleumier, 2013) further informed the approach employed in the study. The therapists utilised their musical, vocal, bodily and facial expressions during the sessions. These made up the auditory and visual inputs provided to the residents within sessions. These sensory inputs served as affective cues which could directly modulate patients' emotions and physiological arousal. Four key constructs of the sessions were identified. These are discussed in terms of the therapist's auditory and visual cues:

Auditory cues:

1) Well-known songs were used, such as My Bonnie Lies over the Ocean. These provided repetition of musical elements and properties, e.g. rhythm, tempo, pitch and melody, and were employed to modulate residents' arousal (See 2.6.5 Musical expression in Chapter 2). The therapists would intuitively transpose the keys of their instrumental playing and alter their singing voices to either soothe or invigorate the residents.
2) Improvisation was also used as part of the well-known songs or vice versa to enhance residents' emotions and to promote their participation in the joint music-making. It is necessary to note that the improvisation employed in this context did not refer to the improvisation performed in a formal classical or jazz concert. This was a process of free music-making between the resident and the therapist as discussed in (See 2.6.5 Musical expression in Chapter 2). It allowed the residents to respond by freely playing the instruments or simply exploring the sounds of the instruments.
3) Talking, as similar to a psychotherapy session, also formed part of the session, allowing reminiscence and the expression of feelings. The therapists would use emotion regulation techniques, such as positive humour (Samson and Gross, 2012) and reappraisal, to direct residents' attention to retrieving semantic or positive autobiographical memories in order to offset emergent anxiety and

apathy (See 2.7.2 Attentional deployment and 2.7.3 Cognitive change in Chapter 2). When speaking, the therapist would also adjust their spoken utterance and use nonverbal vocal expressions such as laughter to modulate the residents' emotions (See 2.6.4 Vocal expression in Chapter 2). Short phrases or sentences were also used in order to facilitate communication with the residents.

Visual cues:

4) Facial and bodily expressions were given prominence and utilised as part of therapists' musical and verbal expressions. These expressions could generate emotional reactions through audio-visual binding as discussed in section 2.6.2 and 2.6.3 in Chapter 2. These also provided non-verbal contextual cues to facilitate therapist-resident communication.

The section above outlines the key constructs of the music therapy intervention. An in-depth discussion of the intervention will be further presented in the two case studies in Chapter 5 and 6.

**Video presentations**

After each session, the video recording of the session was reviewed by the therapist and research assistant. This enabled the selection of two video excerpts to be presented to the care staff participants in the intervention group unit. This 15-minute video presentation was carried out in order to help the carers in the intervention group continue to prevent and manage symptoms after therapy sessions.

**Criteria for selecting video excerpts**

1. Each video excerpt should last no more than 3 minutes.

2. Each video excerpt should present either of the below description:

*a)* Emergent symptoms are reduced through direct therapist-resident interaction.

*b)* Patient's engagement in therapist-resident verbal, musical or nonverbal interaction, using any of the residual functions, including orienting response, attention (selective, alternating, divided and sustained), memory (working, sensory, semantic, episodic, autobiographical, and procedural) and sensorimotor integration (i.e. listening to rhythmic music triggers foot tapping).

After selecting the clips, the NICE Dementia Pathway (National Institute of Health and Care Excellence, 2006) was used as a framework to address:

1) How the therapist uses interaction techniques to de-escalate emergent symptoms.
2) The possible causes of such symptoms by probing aspects, including physical health, undetected pain or discomfort, side effects of medication, individual biography, psychosocial factors, physical environmental factors, behavioural and functional analysis.
3) Based on each individual resident's residual functions (i.e., the types of attention and memory and the modalities of sensorimotor integration), identifying other individualised emotion regulation strategies (i.e., situation modification, attentional employment cognitive change and response modulation), which can be used to manage symptoms in everyday life.

A communication sheet was used to record the main points of the presentation. Carers were encouraged to also record instances in which they had used learned ideas from the presentation during the week with residents.

As mentioned earlier in the literature review, carers' strategies and characteristics are central to the management of symptoms (de Vugt et al., 2004; Sink et al., 2006). Teaching carers to adjust their interactions with people with dementia is also noted to have lasting effectiveness for managing neuropsychiatric symptoms (Livingston et al., 2005). The Video Presentation element as an intervention in this project was developed with these views to extend the effects of weekly music therapy into the staff day-to-day practice. The video clips allowed the music therapist and research assistant to clearly demonstrate what could be done to prevent the triggers of the symptoms and to effectively minimise the symptoms when they appeared. This weekly intervention aimed to embed the practicable knowledge, methods and techniques into carers' interaction with the residents in their everyday life. As staff active involvement is one of the key strategies in making psychosocial interventions work (Lawrence et al. 2012), weekly video presentations were identified as the most time efficient method in this study to sustain consistent staff involvement. The development of the intervention took into account the factors such as staff time, priorities and risk that could impede the implementation. For example, staff participation in the therapy sessions could put a strain on their time for fulfilling other duties. Their presence in the sessions could also be an intrusion into the resident participants' one–to-one therapy and compromise confidentiality. By carefully reviewing and selecting the video clips, the music therapist and research assistant were able to filter out certain sensitive information and only relay the most useful information to the staff in the 15-minute presentations.

The staff who participated in the weekly video presentations were encouraged to apply what they had learned as well as their own ideas into their daily practice. The feedback from the staff during the video presentations also in turn informed the music therapists' working strategies in the therapy sessions. This intervention explored the possibilities of using music therapy as an ongoing training tool which could be included as part of carers' day-to-day work. This would intend to help improve staff knowledge of their patients and staff confidence and skills to interact with the patients. As a result, a task-oriented care approach may be shifted to a resident-centred approach.

**Standard care**

Resident participants in the control group received standard care only for 5 months. This consisted of medical and personal care, provision of basic needs, and activities carried out as usual within the home such as chaplaincy services, entertainment and leisure activities.

### 3.5.4 Outcome assessments

The Neuropsychiatric Inventory and Dementia Care Mapping were conducted at four time points: at Baseline, Month 3, Month 5, and as a follow-up at Month 7.

**The Neuropsychiatric Inventory for Nursing Homes (NPI-NH)**

The NPI-NH (Wood et al., 2001) is a semi-structured interview for use in nursing homes that collects data on residents' neuropsychiatric symptoms of dementia. Interviews were conducted with care staff participants by two researchers who followed the suggested protocol by Wood et al (2001). The interview assesses 12 areas of behaviour and neuropsychiatric functioning: delusions, hallucinations, agitation, depression, anxiety, euphoria, apathy, disinhibition, irritability, aberrant motor behaviour, night-time behaviour and appetite disturbance. Each symptom is scored according to its perceived frequency (scale of 0–4), severity (0–3) and level of occupational disruptiveness to staff (0–5). Occupational disruptiveness concerns the effect of the symptom on the carer's daily practice, with regards to work routine and emotional impact, with 0 indicating no disruptiveness and 5 indicating 'very disruptive', a high score also indicates that this behaviour is a major source of distress for staff and other residents, which requires carers' time usually devoted to other residents or activities. An overall score for each symptom is calculated by multiplying frequency by severity. A score of greater than 3 is commonly taken to be indicative of clinically relevant symptoms (Aalten et al., 2007). Each score is added together to give a total NPI score; the highest achievable score is 144. The NPI has been proven to be valid, reliable and sensitive to change, and has been used in a number of clinical trials (Ballard et al., 2002; Raglio et al., 2010; 2013).

**Dementia Care Mapping (DCM)**

DCM is an observational tool used within institutional settings that provides information on residents' well-being and the quality of care delivered by staff (Brooker and Surr, 2006). Several studies have posited that relative wellbeing is an appropriate outcome measure in dementia care (Kitwood, 1997b; Brooker and Duce, 2000), and DCM has been used as an outcome measure in a number of clinical trials (Ballard et al., 2001a; 2001b; Gigliotti, Jarrott and Yorgason, 2004).

During mapping sessions, the research assistant recorded residents' behaviours, mood, engagement and interactions with staff over a defined time period. Participants were observed for two consecutive hours over lunchtime. Residents' behaviours, mood and engagement were systematically coded within 5-minute time frames. Behaviours were coded as a letter, e.g., 'F' for eating, 'N' for sleeping, 'L' for engaging in a leisure activity. Mood and engagement were scored between −5 and +5, with −5 indicating very low mood and/or low level of engagement with the environment, and +5 indicating considerably positive mood and/or high level of engagement with the environment. The mood and engagement scores for each time frame were then analysed to give an overall 'wellbeing' score between −5 and +5, with a negative score indicating ill-being and positive score indicating well-being. In addition, staff-resident interactions were recorded as and when they occurred during a dementia care map, according to type and potential for well-being, and were named as ‘personal detractor’ or ‘personal enhancers’. The study explored the percentage of personal enhancers in carer-resident interactions contributing to the quality of person-centred-care being delivered.

**Physiological data**

Data on residents’ physiological state were collected during sessions and immediately before and after with a Polar heart rate monitor RS800. The heart rate monitor attaches to the wrist and the chest, and measures residents’ heart rate and heart rate variability. The monitor was attached by a carer and the researcher. The resident was then encouraged to relax in the therapy room in a comfortable chair for 15 minutes before the session. This was repeated for 15 minutes following the session. This aimed to provide data on residents’ physiology at a resting baseline state. The analysis of the physiological data from the heart rate monitor was part of the case study, which will be discussed in the ensuing section of case study.

**Semi-structured interviews**

During the 6th month, semi-structured interviews with care staff were conducted to explore their perceptions of music therapy and its effects on residents within the intervention group. The interview questions were:

1) Do you think music therapy can have a positive or negative effect on the residents?
2) Have you seen a change in residents’ symptoms or well-being since they started receiving music therapy?
3) What did you feel about the video presentations? What made the strongest impression on you?
4) Has your experience of music therapy changed the way you work?
5) What would you like to learn from the music therapists?

### 3.5.5 Data collection procedure

In each care home, a quiet room on the intervention unit was utilised for the music therapy sessions. A separate room was employed for the reviewing of data. At the start of the day the music therapist and research assistant set up the music therapy room with an electronic keyboard, two chairs and various percussion instruments including xylophones, a drum, suspended cymbal, tambourines and beaters. Two video cameras were set up with tripods to record the sessions, one as a back-up. In the second room the research assistant set up the computers, and set the heart rate monitor to the correct time.

Before each session the resident was asked whether they were happy to attend. If yes, the heart rate monitor was attached by a carer. The resident was then seated in the music therapy room for 15 minutes to collect baseline physiological data. The music therapist conducted the session, after which the resident remained seated for 15 minutes resting time. The resident was then assisted back to the communal area and the sensors were removed by a carer. The research assistant uploaded the data from the sensors and the video camera. This was repeated with the remaining residents. The research assistant and music therapist then reviewed the video recordings of sessions and selected clips. A presentation using these clips was given to participating carers in the afternoon.

The research assistant collected data for the outcome measures at four time-points; 2 weeks were allocated at each time-point to collect this data. The research assistant carried out the 2-hour Dementia Care Map over lunchtime in each unit, and observed the participants over this period from a discreet position in the corner. The research assistant carried out the NPI-NH interviews with care staff participants before and after the Dementia Care Map, in a quiet room on the unit. This routine was repeated in the remaining units on subsequent days.

### 3.5.6 Sample size

Being a feasibility study, a formal sample size calculation was not performed. The sample size was selected based on what would be feasible for the music therapists, researchers and care staff. Key considerations were the amount of time necessary to conduct interviews, sessions, and review video recordings. It was estimated that a typical day would consist of: 1 hour for therapist and research assistant to prepare instruments, recording equipment and heart rate monitor; one 30-minute music therapy session per resident with 15-minute resting time pre- and post-session; 1 hour per session for therapist and research assistant to review video recording and select clips; one 15-minute presentation to carers including resulting discussion and questions; and a flexible amount of time before and after each session for a carer to attach and remove the sensors. Regarding staff participants, a key consideration was the number able to participate without compromising their daily delivery of care to all residents on the unit. In view of this it was decided that 3 sessions per day could be conducted. An optimum number of 16 resident participants and 10 staff participants was calculated.

### 3.5.7 Randomisation

Randomisation was carried out between units (cluster randomisation) to reduce contamination across the control and intervention groups. After participants had been recruited by the researchers, randomisation was conducted by the study statistician independently of the researchers. Random decimals were generated using the RAND() function in Microsoft Excel 2008 for Mac Version 12.3.5. These were used to allocate the care home units to either the control or intervention group. The randomisation was stratified by care home so that there was an allocation of both control and intervention represented within each care home. The outcomes were then provided to the researchers who then implemented the allocations.

### 3.5.8 Blinding

Blinding was not carried out. It would not have been possible to conceal which group participants were in, due to the nature of the intervention. The music therapy sessions took place within the care homes and participants could be observed and heard attending the sessions.

### 3.5.9 Data analysis

**Statistical analysis**

To analyse the effects of music therapy compared to standard care, two approaches were used. First, descriptive analyses were conducted, in which means and standard deviations were analysed at each time point. The developments over the 7 months between groups were then displayed graphically. Secondly, inferential statistical analyses were conducted using repeated measures analysis of variance (ANOVA), with the within-subjects factor Time (with levels Baseline, 3 months, 5 months, and 7 months) and between-subjects factor Condition (with levels Control and Intervention). This allowed investigation of whether there were significant differences in levels of symptoms, wellbeing, occupational disruptiveness and Personal Enhancers over time, within each group and between the two groups. The analysis provides contrasts for the Time x Condition interaction. These assessed whether the change between two time points was the same for the Control and the Intervention. This was performed for the pairs of time points Baseline vs 3 months, Baseline vs 5 months, and Baseline vs 7 months. This interaction effect was obtained as a contrast in SPSS defined by the two subcommands MMATRIX and LMATRIX. The effect size measure partial eta squared was obtained from this and was converted to Cohen's d according to DeCoster (2012). This was a feasibility study and due to the small sample size, certain statistical requirements could not be satisfied, therefore no cluster adjustment or multiple outcomes were performed. SPSS computerised package version 20 was used for all statistical analysis.

**Qualitative analysis**

The method of thematic analysis (Braun and Clarke, 2006) was employed for the data of the semi-structured interviews with staff participants. This method involved a process of familiarisation with data, transcription of verbal data, generation of initial codes, searching, reviewing and naming themes, and report production. This is carried out by two investigators who crosschecked for reliability. NVivo computerised package version 10 was used for data analysis.

## 3.6 Procedure: Phase Two- Single case study

As stated earlier, the purpose of this mixed-methods single case study design was to further explore how individual music therapy sessions might work through the in-depth analysis of quantitative and qualitative data. The main quantitative data was two resident participants' heart rate data collected from their respective 4 therapy sessions. The main qualitative data was the written observations of 16 video excerpts, which were completed by a cognitive psychologist and a music therapist. The triangulation of both types of data helped shed light on how the therapist managed to induce a change in the participants' heart rates and behaviours. The case study approach was initially employed to study all 6 resident participants in the intervention group of the feasibility study. However, due to the loss of therapy sessions, technical issues with the equipment as well as several participants' occasional refusals of video recording and/or heart rate monitor, more complete data was collected for only 2 participants who had the same therapist. Therefore, the results of the two case studies were used to support the findings of the feasibility study and to refine an identified theoretical model of the intervention.

The following sections will provide the information of the two participants, followed by the procedure and methods of data collection and analysis.

### 3.6.1 Participants

The two participants, who were included in the feasibility study, were from the same intervention unit. They were both diagnosed with Alzheimer's disease. They presented different levels of neuropsychiatric symptoms and functioning. The differentiation of their residual cognitive abilities allowed the participants to engage contrastingly in the music therapy sessions. Participant A was more able to engage in music making whereas B in verbal discussions. Table 3.1 presents the profiles of the two resident participants.

| **Participant** | **A** | **B** |
|---|---|---|
| **Gender** | Female | Female |
| **Months lived at home at start of project** | 29 | 12 |
| **Diagnosis** | Alzheimer's disease | Alzheimer's disease |
| **Global Deterioration Scale** | 6 (moderately severe dementia) | 5 (moderate dementia) |
| **NPI score at baseline** | 21 | 9 |
| **DCM Wellbeing score at baseline** | 1 | 1 |
| **Number of sessions attended** | 18 | 19 |
| **Medication** | Citalopram 10mg (anti-depressant) | Donepezil Hydrochloride 10mg<br>(Anti-dementia) |
| **Neuropsychiatric symptoms** | Aberrant vocal noise<br>Agitation | Anxiety<br>Delusional ideation<br>Low mood and apathy |

Table 3.1 Profiles of the two resident participants

### 3.6.2 Procedure

The case study was based on a sequential explanatory mixed-methods design (Creswell et al., 2003), in which the qualitative data was used to explain the initial quantitative results. In a chronological order, the procedure of the case study involved 4 steps:

1) Coding the time sequences of the behaviours of each participant and the therapist over 4 videoed therapy sessions.
2) The heart rate analysis was then conducted in correspondence with each time-sequenced behaviour of the participants during the sessions.
3) The results of the heart rate analysis enabled the selection of short video excerpts, which were then observed by a cognitive psychologist and a music therapist.
4) The written observations of the video excerpts were qualitatively analysed with an interpretive hermeneutic phenomenological approach by the author of the current study. This process allowed the results of the hermeneutic phenomenological analysis to explain underlying physiological mechanisms of the participants' behaviour as a result of the therapist's inputs in the sessions.

As each of these steps involved specific procedures and the use of quantitative and qualitative analytical methods, the following sections will chronologically discuss each step in detail.

### 3.6.3 Video coding of time-sequenced behaviours

Direct observation through recordings of activities has been a research method used to study human and animal behaviours (Martin and Bateson, 2007). In music therapy research, various methods of video analysis have been widely used to study nonverbal communication, relationship and interaction in therapy with diverse clinical populations (Wosch and Wigram, 2007). Video observation allows researchers to measure behaviours, which pertains to "the action and reaction of whole organisms" (Martin and

Bateson, 2007, p.3). Therefore, measuring behaviours is to quantify the action and reaction by "assigning numbers to observations according to specified rules" (ibid. p.4).

Accordingly, the video coding employed in the current study was to quantify the musical, verbal, nonverbal and mixed expressions of the participants and the therapist during the therapy sessions. An excel spread sheet was designed to facilitate the quantification of these four types of expression (see Appendix 2). Several specified actions were identified within each of these four types of expression. These expressions and their specified actions are defined and coded as follows (also see Appendix 2, column A, B, C):

1) Musical expression (coded second by second using the colour yellow with a mesh effect for the client in Row 4 and only the colour yellow for the therapist in Row 6) includes instrument playing (coded with the letter I in Row 5 for the client and Row 7 for the therapist), movements to a musical beat (coded with the letter M, see Row 5 and 7), singing and vocalisations which produce melodic or rhythmic patterns (coded with the letter V).
2) Verbal expression (blue with a mesh effect for the client and blue for the therapist) includes general conversations (G), reminiscence (R) and verbalisation involving the display of certain emotions or discussion of certain feelings or emotions (E).
3) Nonverbal expression (pink with a mesh effect for the client and pink for the therapist) includes eye contact (C), staring at one place (S), bodily movements irrelevant to the music (B) and Facial expression (F).
4) Mixed expression (green with a mesh effect for the client and green for the therapist) includes a mixture of expressions which fits in with none of the above expressions.

The occurrences and ends of these four types of expression were sequenced in line with timings of the session (see Row 8) and the real time (See Row 9). A second spread sheet was set up to show the time spent on each expression and a third spread sheet to show the time spent on each specified action. These expressions and actions were subsequently presented in bar charts, which were automatically produced using the data collected in the spread sheets. These bar charts will be presented in the discussion of the two case studies in Chapter 5 and 6. The spread sheet used to quantify the video observation of behaviours was developed through a period of testing and modifications prior to the case study. This method was also presented in PhD seminars with peer researchers and academics. The guidelines for using this spreadsheet are included in Appendix 2.

### 3.6.4 Selected sessions for video coding of time-sequenced behaviours

Four videoed sessions from towards the end of the intervention period for each participant were chosen for video coding of time-sequenced behaviours (Table 3.2):

Table 3.2 Four selected sessions for video coding of time-sequenced behaviours

| | Participant A | Participant B |
|---|---|---|
| Session date | 04.07.2013 Session 15 | 22.05.2013 Session 11 |
| Session date | 10.07.2013 Session 16 | 10.07.2013 Session 17 |
| Session date | 17.07.2013 Session 17 | 17.07.2013 Session 18 |
| Session date | 18.07.2013 Session 18 | 18.07.2013 Session 19 |

The decision on using these videoed sessions had several considerations. First, these sessions were chosen as they had no missing pre and post therapy video recordings and physiological data. Additionally, the therapist may have established better working strategies to work with the participants during these sessions and the care staff may have become more familiar with the treatment towards the later part of the intervention period. This has been noted in the previous study by Ridder et al. (2013), which reported a greater effect of the therapy for the later sessions. Due to becoming more used to the presence of the cameras in these later sessions, the participants and therapist may also have reduced reactivity to the cameras, which could have affected the natural course of their behaviours in earlier sessions. Exposing participants to longer periods of camera observation has been suggested as a method to decrease this reactivity and, therefore, improve the data quality (Haidet et al., 2009).

The same research assistant was trained to carry out the coding, in line with the rules described in section 3.6.3 and Appendix 2, for all 8 videoed therapy sessions (4 for each of the two participants). As the same research assistant carried out the coding for all the vidoes, inter-reliability was not statistically tested. However, the research assistant had previously practiced the coding alongside the researcher of the current study who developed the method of video analysis. The researcher of the current study also carried out random checks after the research assistant had completed the coding. The random checks had satisfied the predefined coding rules.

One of the  major aspects in studying behaviours is to proximate causation or control in terms of identifying which stimuli elicit the behaviour and what underlying neurobiological, psychological and physiological mechanisms regulate this behaviour (Martin and Pateson, 2007). To satisfy this, studies would need to employ “an analysis of an organism’s behaviour, which is closely integrated with an analysis of the neural, physiological and biochemical mechanisms that underlie that behaviour” (ibid. p. 5). The purpose of coding time-sequenced behaviours in the current study was to integrate the heart rate analysis and, therefore, explore the psychophysiological mechanism of the participants’ musical, verbal, nonverbal and mixed expressions. The following section will discuss how the heart rate analysis was performed in correspondence with the time sequences of the participants’ expressions.

### 3.6.5 Heart rate analysis and selection of video excerpts

As the video observation identified the time-sequenced behaviours of the participants and therapist during the sessions, timings of an event (i.e. the time when the therapist started or ended a sensory input and the participant started or ended a reaction to this input) could be identified to select further time segments for the purpose of the heart rate analysis. The heart rate analysis then allowed the subsequent selection of short video excerpts for qualitative analysis. The rationale and procedures are detailed as follows:

The heart is controlled by the two branches of the autonomic nervous system (ANS): the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). These branches generally oppose each other and cannot be active at the same time. The SNS increases heart rate and mobilises the body during a crisis such as a "fight or flight" situation whereas the PNS decreases heart rate and facilitates digestion, growth and energy storage (Bear, Connors and Paradiso, 2007). Heart rate variability (HRV), pertaining to the fluctuations of the interval between each heart beat and referred to as RR intervals (Tarvainene et al., 2014), has been used to indicate the interplay between the SNS and PNS. In psychophysiological research, HRV is used to study arousal, mood and psychological states (Ellis, Koenig and Thayer, 2012). Decreased HRV, as a result of decreased input from the PNS has been found in individuals with depression, mood disorders and poor emotion regulation abilities (Thayer, Friedman and Borkovec, 1996; Thayer et al., 2009). In music therapy clinical trials, Okada et al. (2009) and Raglio et al. (2010) have used HRV as an outcome of interest and reported increased HRV for patients with dementia who received group music therapy.

In order to assess the participants' HR and HRV during their music therapy sessions, the current study adopted the method of ambulatory assessment of emotions (Ebner-Priemer and Kubiak, 2007; Wilhelm and Grossman, 2010). Ambulatory assessment, as opposed to experimental laboratory assessment, allows data to be collected in naturalistic real-life situations. This method has the potential to: “1) assure external validity of laboratory findings, 2) provide normative data on prevalence, quality and intensity of real-life emotion and associated processes, 3) characterize previously unidentified emotional phenomena, and 4) model real-life stimuli for representative laboratory research design” (Wilhelm and Grossman, 2010, p.552). Accordingly, the heart rate monitor Polar RS800 (www.polar.fi/en/) was used to collect the two participants’ heart rate data. This monitor had a sampling rate of 1000 Hz, which is required for reliable recording of the time series of inter-beat intervals (Task Force of the European Society of Cardiology, 1996). The monitor had a sensor embedded in an elastic band, which was fitted around the participants’ chest. The data collected from the sensor was transmitted to a watch, also attached to the participants. The watch logged the timings of heart beats. These were then transferred from the watch to a computer for analysis via infrared. As previous mentioned, the data was collected during the feasibility trial study. Both participants had their heart rate data of resting state collected 15 minutes before (to provide the baseline) and after each of the 4 therapy sessions. However, in order to obtain valid data of the participants’ resting states, only 5 minutes out of each 15-minute raw data set was used. This was to avoid using any data that was disturbed by the participants’ use of cognitive processes, movements and verbalisation. These disturbances or artifacts were removed using the artefact correction function provided by Kubios HRV. The heart rate data was also recorded throughout each of the four 30 minute sessions. The time during each session was segmented into a series of behaviours. Each time segment of behaviour started with a clear occurrence of the therapist’s sensory inputs and ended at the time when the resident stopped displaying any motor outputs. If the resident appeared to be listening to the music, but showed no motor output, the time segment would end at the time when the therapist ceased a sensory input (i.e., the therapist stopped playing music or singing to the resident).

#### 3.6.5.1 Time-domain analysis

The analysis was performed using the computer software Kubios HRV (Tarvainen et al., 2014). Time-domain analysis was performed to estimate the values of various indices of HRV, in line with the time segments, which started with the therapist's input and ended with the clients' ceased motor outputs. These indices of HRV (Table 3.3) included:

| Parameters of HRV | Description | Unit |
|---|---|---|
| Mean RR | The mean of RR (inter-beat ) intervals | Millisecond (ms) |
| SDNN | Standard deviation of RR intervals | ms |
| Mean HR | The mean heart rate | 1/min |
| HR STD | Standard deviation of instantaneous heart rate values | 1/min |
| RMSSD | Square root of the mean squared differences between successive RR intervals | ms |
| NN50 | Number of successive RR interval pairs that differ more than 50 ms | Number count |
| pNN50 | NN50 divided by the total number of RR intervals | % |

Table 3.3 Indices of HRV (extracted from Tarvainen et al. 2014)

The current study used RMSSD and pNN50 as the outcomes of interest to assess the 5-minute pre therapy and 5- minute post therapy resting states for each of the two participants' respective 4 therapy sessions. Previous studies have used both RMSSD and pNN50 (Okada et al., 2009) or just pNN50 (Raglio et al., 2010b) to assess the effects of group music therapy. Both trials reported significant increases in these indices. Additionally, the current study also analysed the mean RR, SDNN, mean HR and HR STD of the participants' time-sequenced behaviours throughout the therapy sessions. The highest and lowest values of these indices were identified to allow for the selection of short video excerpts for the subsequent qualitative analysis.

#### 3.6.5.2 Frequency-domain analysis

Frequency domain analysis was also performed using Kubios HRV. This analysis assigns bands of frequency and then counts the number of inter-beat intervals matching each band. High frequency (HF), from 0.15 to 0.4 Hz, has been used to assess parasympathetic nervous activity (i.e. rest, digestion or restore) whereas low frequency (LF), from 0.04 to 0.15 Hz, to assess sympathetic nervous activity (i.e. mobilisation and fight or flight) (Tarvainen et al. 2014). The software provides two statistical methods, Fast Fourier Transformation and Autoregressive spectral analysis, to estimate relative and absolute powers of High Frequency (HF) and Low Frequency (LF) bands. The relative HF and LF powers are estimated in the unit of milliseconds (ms), whereas absolute HF and LF power are estimated in milliseconds squared ($ms^2$). Accordingly, increased absolute HF powers indicate enhanced PNS activity, which was again previously reported by Okada et al. (2009). The current study used absolute HF powers as the outcome of interest to assess the 5-minute pre therapy and 5- minute post therapy resting states for each of the two participants' respective 4 therapy sessions. The highest and lowest values of relative HF and LF powers as well as the aforementioned mean RR, SDNN, mean HR and HR STD, were used in the current study to enable the selection of short videos. This will be addressed further in the following section.

### 3.6.6 Hermeneutic Analysis of video excerpts

As the selection of video excerpts was based on the highest and lowest values of the aforementioned indices of HRV, the selected video excerpts would display emotional phenomena during the therapist-resident interaction that have an underlying physiological mechanism. Therefore, it allowed further exploration into these emotional phenomena in terms of cognitive, sensory and motor functions via systematic observation of these video excerpts. Results of the qualitative video analysis could later help explain the quantitative heart rate results, such as why HR and HRV became the most or least changeable during certain events in the therapy sessions. As the video observation required health professionals who were familiar with the language of neuropsychological aspects (see section 2.3.2 in Chapter 2), a cognitive psychologist and a music therapist who also obtained a psychology degree carried out the assessments. Prior to the video observation, both observers were given basic information about the two participants, which included the participants' symptoms and functioning outlined earlier in Table 3.1. However, the psychologist and music therapist were not given the results of the heart rate analysis corresponding to the video excerpts, in order to prevent the heart rate results from biasing their observation.

The video observation involved the two professionals observing the video excerpts and using a pre-designed form (Table 3.4), similar to the one described in Ridder (2003; 2007), to write down their observations. The observers watched each excerpt at least 5 times but were free to watch each clip as many times as they needed. They followed the procedure below to assess each clip and wrote down their observations and interpretations in the assessment form:

1) First time: look at what the client is doing in the clip and write down what you have seen, heard and perceived in sequences in Column 1.

2) Second time: Write down any comments/thoughts about the client in Column 2. If possible, link comments in Column 2 and the corresponding observations in Column 1 by underlining them.

3) Third time: Look at what the therapist is doing in the video and write down what you have seen, heard and perceived in sequences in Column 3.

4) Fourth time: Write down any comments/thoughts about the therapist in Column 4. If possible, link the comments in Column 4 and the corresponding observations in Column 3 by underlining them.

5) Fifth time: Answer the questions in Column 5 and underline any corresponding observations and comments.

Table 3.4 Video analysis form

| What is the client doing in this clip? | Have you noticed any particular changes in the client?<br><br>If yes, what are they? (e.g. symptoms including mood/emotion, motivation and behaviours or functioning including attention, memory, sensorimotor skills and verbal and musical abilities…) | What is the therapist doing in this clip? | Have you noticed any particular expressions used by the therapist?<br><br>If yes, how did the therapist use these expressions? (e.g. bodily/facial/vocal/verbal expressions and the characteristics/types /elements of music, quality of sound and timbre employed) | Can you see a relationship between your observation about the therapist and your observation about the client?<br><br>If yes,<br>1) What is this relationship?<br>2) What does this relationship mean? |
|---|---|---|---|---|
| Sequence 1<br><br>Sequence 2<br><br>Sequence 3<br><br>Sequence 4 | | | | |

The form was used for each selected video excerpt to produce written text from the two observers. Over a period of one week, the observers were given the access to the video excerpts in order for them to repeat their observations and thus reflect and revise their written text until they were satisfied with their written observations. The written text served as the qualitative data, that was then analysed based on the framework of hermeneutic phenomenology, discussed in the next section.

#### 3.6.6.1 Framework of hermeneutic phenomenology

Hermeneutic phenomenology, also known as interpretive phenomenology, originated from writings by Martin Heidegger (1889-1976) and Hans-Georg Gadamer (1900-2002)

(Laverty, 2003). Hermeneutics is the interpretation of text or language of an observer to understand the meanings of human experiences. In Heidegger's view, the observer cannot remove him or herself from the process of identifying the essences of these human experiences or phenomena as he or she exists with the essences (Sloan and Bowe, 2014). Research, using a hermeneutic phenomenological approach, pays attention to factors, such as time, participants' existence and relation to the world around them (ibid. p.8). In addition, this approach emphasises researchers' retrospective reflection on lived or past experience of human existence as part of an investigation of the nature of a phenomenon (van Manen, 1990; 2007). Therefore, researchers' empathy and relevant prior experience are of importance in data analysis and interpretation of meanings (Sloan and Bowe, 2014, p.13).

In the current study, the cognitive psychologist and music therapist were both the observers of the two care home residents' experiences of music therapy. Their experience with this client group as well as their understanding of neuropsychological aspects helped them reflect and interpret the meanings of music therapy for the residents. The author of the current study, who was also the music therapist for the two resident participants during the feasibility trial, then analysed the cognitive psychologist and music therapist's written observations using the three theme types suggested by van Manen (1990):

1) Temporality (lived time): What were the timings of events in the video excerpts?
2) Corporeality (lived body): How were the events manifested by the actions of the residents and therapist?
3) Relationality (human relation): What was the causal relationship between the therapist's inputs and residents' responses?

Data analysis was completed using NVivo Computerised Package Version 10.The results of the analysis were then used in combination with the results of the heart rate analysis to help interpret how individual music therapy worked for each of the residents.

### 3.6.7 Reliability and validity

In qualitative research, reliability and validity have been translated into concepts such as Credibility, Neutrality, Consistency or Dependability and Applicability or Transferability (Lincoln & Guba, 1985). Latvala, Vuokila-Oikkonen and Janhonen (2000) discussed that video recordings could reinforce credibility by allowing researchers to repeat observations, which corresponds to the real world and allows all aspects of a situation to be obtained to help interpret a phenomena. In the current study, the video recordings integrated the analysis of heart rate data in order to improve validity and reliability by ensuring triangulation. Triangulation is necessary as it strengthens a study by using several kinds of methods and data, including both quantitative and qualitative approaches (Patton, 2001 cited in Golafshani, 2003). In the current study, this was manifested through the use of multi-layered data collection and analysis, which included the video coding of time-sequenced behaviours, heart rata data analysis and hermeneutic analysis of short video excerpts. In addition to method and data source triangulation (Lincoln and Guba, 1985; Jones, 1996), "investigator triangulation" (Johnson, 1997) was ensured through PhD seminars at Anglia Ruskin University, which allowed the researcher to present research issues to peer researchers and research supervisors. This invited other researchers' ideas, explanation and interpretation of the data to reduce bias and increase the trustworthiness of the study.

# Chapter 4 Results: Cluster randomised controlled feasibility study

## 4.1 Introduction

This chapter presents the results from the cluster randomised controlled feasibility study. As discussed in the previous chapter, the study design included both qualitative and quantitative strands. However, the feasibility study was quantitative-dominant and, therefore, is reported based on the recommendations of reporting feasibility studies by Thabane et al. (2010), which were adopted from the Consolidated Standards of Reporting Trials (CONSORT) (Moher et al., 2010). Accordingly, the discussion will focus on the major aspects of feasibility, which include recruitment and retention, acceptability and preliminary quantitative and qualitative outcomes.

## 4.2 Recruitment

Recruitment was carried out from January to February 2013. A total of 27 participants were recruited into the study, comprising 17 residents and 10 staff from two care homes. Prior to data collection, 76 resident participants, who resided in the dementia care units of the two homes, and 12 staff participants, who worked in these units, were assessed for eligibility. 17 residents (22 %) met the inclusion criteria and consent was sought from next of kin. Consent was given for all 17 resident participants (100 %) and all completed the baseline assessment. 10 staff (83 %) met the inclusion criteria and all (100 %) gave consent. After the baseline data collection in February 2013, the participating residents and carers were allocated to either standard care or music therapy, according to how the unit they resided or worked in had been randomised. At Home 1, there were 4 residents and 2 carers in the intervention group and 3 residents and 1 carer in the control group. At Home 2, 5 residents and 5 carers were recruited for the intervention group and 5 residents and 2 carers were recruited for the control group. Thus, in total, 9 residents and 7 carers were allocated to the music therapy group and 8 residents and 3 carers were allocated to the standard care group. Follow-up data was collected at the end of the study in September 2013.

## 4.3 Baseline data

Baseline characteristics (see Table 4.1) were collected following recruitment of participants. The majority of resident participants were female (94 %). The age range was 56 to 98 years, with a mean of 84 years. The majority of resident participants were diagnosed with dementia of Alzheimer's type (41 %). The remaining residents had diagnoses of Vascular, Frontal Lobe, Lewy Body and Mixed Type Dementia, while 18 % of participants had an Unspecified dementia diagnosis. All diagnoses were made in accordance with the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). At the start of the project, 6 % of residents were prescribed anti-psychotic medication, 41 % were prescribed anti-depressant medication and 35 % were prescribed anti-dementia medication. The majority of staff participants were female (78 %). Staff ranged in age from 21 to 60 years, with a mean of 38 years. The length of staff employment prior to recruitment ranged between 3 months and 7 years, with a mean duration of 2 years 5 months. One member of staff did not provide demographic data and is excluded from Table 4.1.

Table 4.0.1 Baseline evaluation

| **Features at baseline** | **Music Therapy Group (*n* = 9)** | | **Standard Care Group (*n* = 8)** | |
|---|---|---|---|---|
| | *n* | Mean (s.d.) | *n* | Mean (s.d.) |
| Global deterioration Scale | 9 | 5.89 (1.05) | 8 | 5.50 (1.31) |
| Symptom score (NPI-NH) | 9 | 14.33 (9.85) | 8 | 15.63 (7.87) |
| Wellbeing score (DCM) | 8 | 0.85 (0.52) | 8 | 1.54 (0.53) |
| Age | 9 | 84.56 (6.64) | 8 | 82.50 (13.04) |
| Female gender, % | 8 | 89% | 8 | 100% |
| Months lived at care home | 9 | 20.33 (10.58) | 8 | 19.75 (20.14) |
| | | | | |
| Medication, % | | | | |
| Antipsychotic medication | 1 | 11% | 0 | 0% |
| Antidepressant medication | 3 | 33% | 4 | 50% |
| Antidementia medication | 3 | 33% | 3 | 38% |
| | | | | |
| Diagnosis, % | | | | |
| Alzheimer's | 4 | 44% | 3 | 38% |
| Vascular | 2 | 22% | 0 | 0% |
| Frontal lobe | 2 | 22% | 0 | 0% |
| Lewy Body | 1 | 11% | 1 | 13% |
| Mixed | 0 | 0% | 1 | 13% |
| Unspecified | 0 | 0% | 3 | 38% |
| | | | | |
| Staff age | 6 | 38.17 (17.11) | 3 | 38.00 (11.53) |
| Staff length of employment | 6 | 32.33 (28.90) | 3 | 23.33 (28.31) |
| Staff female gender, % | 5 | 83% | 2 | 67% |
| Personal Enhancers (DCM)*, % | | 87.50% (17.68) | | 94.45% (7.85)) |
| Occupational Disruptiveness (NPI-NH) | 6 | 2.67 (1.61) | 7 | 3.00 (1.49) |

*the percentage of personal enhancers is calculated using the following formula:

((Personally enhancing interactions + 2(Highly personally enhancing interactions)) / (2(Highly personally detracting interactions) + Personally detracting interactions + Personally enhancing interactions + 2(Personally enhancing interactions))) * 100

## 4.4 Retention

### Residents

3 resident participants from the music therapy group (33 %; 18 % of total number of resident participants) died due to a decline in physical health before the 3 months data collection. Their baseline results were not included in the final analysis. There is missing data due to 1 resident participant from the standard care group being hospitalised before the 7 months data collection and 1 resident participant from the music therapy group absent during the dementia care mapping observations (together comprising 12 % of total resident participants). The results were analysed respectively using the data from the 13 completers of the Neuropsychiatric Inventory (71 %) and 12 completers of Dementia Care Mapping (71 %). See flow diagram, Figure 4.1, for details.

### Staff

1 member of staff from the control group (11 % of total staff participants) dropped out of the study following recruitment, before data collection commenced.

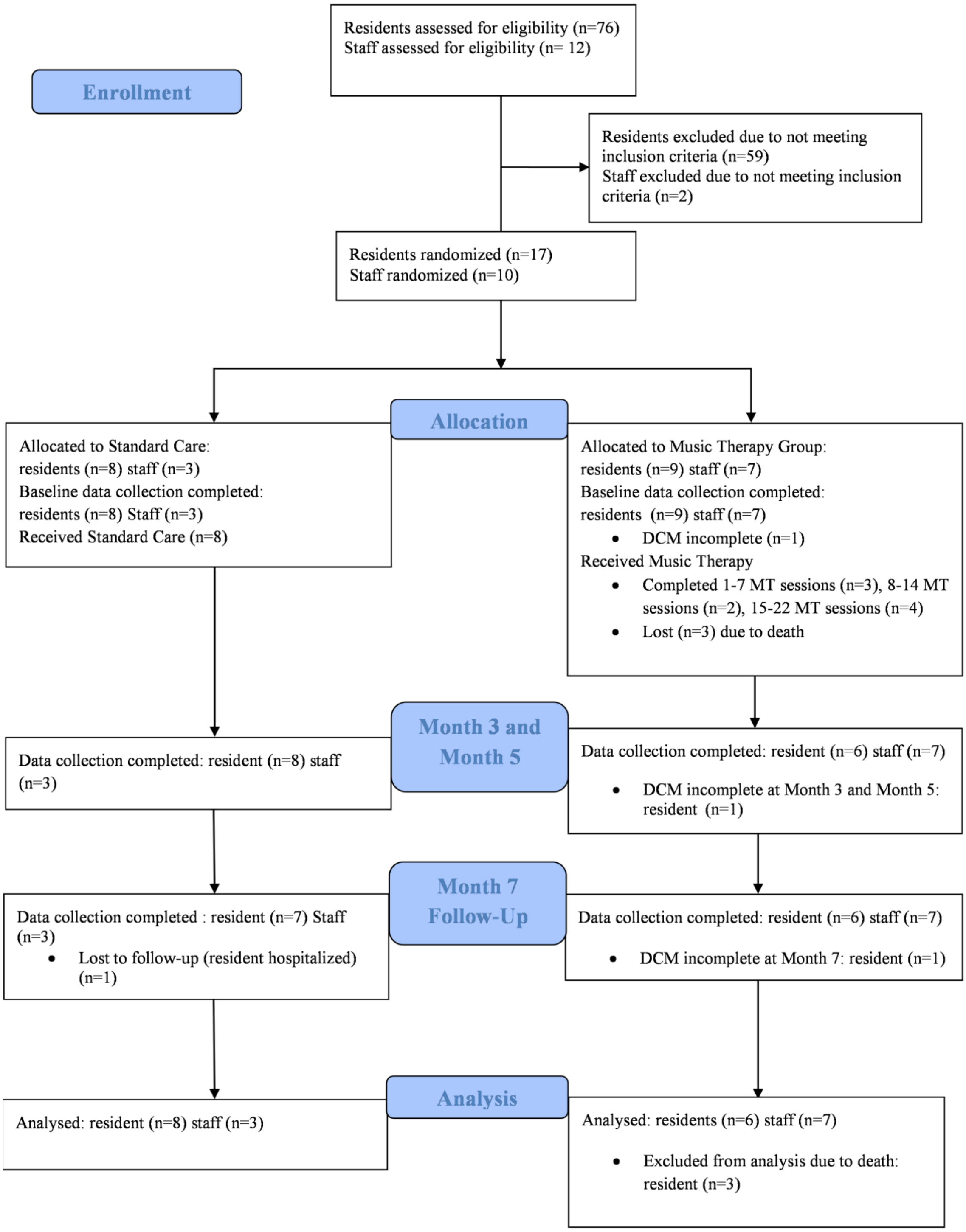
### Sessions

In the music therapy group, 22 weekly therapy sessions were offered to 8 residents. One resident was offered 19 as consent was not received until later in this case. The mean number of attended sessions was 15 (75.11 %) (standard deviation = 4.08). On average, 5 sessions were missed (standard deviation = 3.94).

## 4.5 Numbers analysed

Only data from the completers (14 residents) were analysed. Intention to treat analysis was not performed due to the low sample size, as the effect of dilution would have been high.

Figure 4.1 Participant flow



## 4.6 Acceptability

During the recruitment process, residents' next of kin expressed positive attitudes to residents' involvement in the study. Participant consent was provided for all residents. On average, residents attended 75.11 % of available sessions. A mean number of 5 sessions were missed (standard deviation = 3.94). Reasons for missed sessions included resident illness, therapist illness, resident asleep, and resident choosing not to attend. On the part of the resident, the most common reason for lack of attendance was choosing not to attend (11 occurrences). These occurrences were contributable to only two residents, one of whom declined 9 times. Allowing for flexible start times of sessions was the key to maximising attendance. It was commonly found that if a resident initially chose not to attend, they would likely accept the session if approached again later. Of the 6 completers receiving music therapy, 4 were accepting of the physiological sensor, one was not comfortable wearing the device and one varied in her acceptance of it, depending on her mood and presentation of symptoms. It is recommended that future studies should employ devices that require minimal input to attach, such as those worn on the wrist.

Regarding staff attitudes to the project, the results from the semi-structured interviews indicated a high level of acceptability of the intervention, and the study as a whole, from staff participants. No staff in the intervention group dropped out, in comparison to one carer in the control group who received no intervention. This was due to personal reasons and not study demands. 100 % of intervention group staff reported that they would recommend music therapy for someone with dementia and positive effects on residents. Comments included: "I would recommend it for everyone" and "Please come back! Carry on". Staff spoke of how they enjoyed the presentations and that they wanted to share what they had learnt with their colleagues:

> "[The videos] were quite beneficial to us".

"Amazing! I really could not believe…I actually wanted to go out the door and just go and tell everybody".

Despite positive attitudes, it was not always possible to conduct the presentations due to staff shortages, which resulted in time restraints for the carers. On these occasions, presentations were prepared after the sessions but given the following week.

## 4.7 Preliminary quantitative outcomes

### 4.7.1 Effects of music therapy on symptoms and well being

The primary outcomes for symptoms of dementia and well-being are reported in Table 4.2. Mean Neuropsychiatric Inventory (NPI-Nursing Home Version) scores and Dementia Care Mapping (DCM) scores are displayed for the two groups. Figures 4.2 and 4.3 illustrate these in graphical form.

Table 4.3 summarises the contrast in changes between each pair of time points (Month 3-Baseline, Month 5-Baseline and Month 7-Baseline) between the two groups. Whilst dementia symptoms (indicated by NPI scores) in the standard care group increased over 5 months, dementia symptoms in the music therapy group decreased. This trend continued for both groups after the intervention ended (See Table 4.2 and Figure 4. 2). Significant differences between groups were found for each pair of time points.

The greatest change between groups was found between baseline and Month 7 (−25.52; 95 % CI: [−39.10 to −11.95; $p = 0.002$]). This corresponded to a large effect size (2.32). Staff perceptions of residents' levels of occupational disruptiveness were also assessed. Staff were asked how disruptive they felt each residents' symptoms were to their daily delivery of care. This is illustrated graphically in Figure. 4.4. Occupational disruptiveness in the standard care group was found to increase steadily over the course of the project and continued to increase during the 2 months following the cessation of the music therapy programme (showing an overall increase of 10.86). Within the music therapy group, an increase in residents' occupational disruptiveness was also observed from Baseline to Month 3 (1.33) but this was then followed by a steady decrease from Month 3 to Month 7 (−3.17). The greatest difference between groups was found between baseline and month 7 (−12.69, 95 % CI: [−18.50 to −6.88; $p = 0.001$]) with an effect size of 2.69.

In terms of wellbeing (as measured by the DCM scores), there was an increase over time in the music therapy group from baseline to month 7. In contrast, the wellbeing level for the standard care group decreased over this time period (see Table 4.2 and Figure 4.3). All differences between groups were statistically significant for each pair of time points, with the greatest change found between baseline and month 5 (4.14, 95 % CI: [1.97 to 6.31; $p = 0.002$]) with a large effect size of 2.48. Both groups displayed a decrease in wellbeing between month 5 and month 7 when there was no intervention (see Table 4.2 and Figure 4.3).

Overall the analysis of variance indicated significant differences between the standard care and music therapy groups for levels of symptoms (13.42, 95 % CI: [4.78 to 22.07; $p = 0.006$]), occupational disruptiveness (6.95, 95 % CI: [2.43 to 11.47; $p = 0.006$]) and wellbeing (−0.74, 95 % CI: [−1.15 to−0.33; $p = 0.003$]).

### 4.7.2 Effects of music therapy on caregiving

During the Dementia Care Mapping to observe the interactions between staff and resident participants, occurrences of personally enhancing interactions were identified and coded. Table 4.3 reports the patterns of change in the levels of Personal Enhancers in both groups. However, differences between the groups were not statistically significant (−1.59; 95 % CI: [−127.81, 124.64; $p = 0.962$]). The impact of music therapy on caregiving, however, was further explored qualitatively with the analysis of carer participants' semi-structured interviews at the end of the intervention.

### 4.7.3 Medication

The majority of residents' medication remained the same throughout the project. However, one resident in the music therapy group was previously prescribed an antipsychotic drug (Quetiapine) which was resumed at the beginning of the music therapy programme. This was replaced with an alternative, Risperidone, 3 weeks later. The dosage was subsequently reduced. Several weeks after the music therapy programme had finished, the dosage was increased again. In addition to the antipsychotic medication, this participant's antidepressant medication (Citalopram) was reduced in dosage towards the end of the music therapy programme. One participant in the standard care group commenced an antipsychotic drug (Risperidone) two months after the project started. This prescription remained for the duration of the project.

Table 4.0.2 Group means and percentage of Personal Enhancers during music therapy and standard care

| **Outcomes** | **Baseline** | | **3 Months** | | **5 Months** | | **7 Months** | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** |
| **Symptom Score (NPI-NH)** | | | | | | | | |
| Music Therapy | 6 | 17.33 (10.78) | 6 | 10.83 (14.11) | 6 | 12.33 (11.20) | 6 | 8.67 (9.54) |
| Standard Care | 7 | 17.57 (6.08) | 7 | 24.29 (8.86) | 7 | 26.57 (7.14) | 7 | 34.43 (7.37) |
| **Disruptiveness Score (NPI-** | | | | | | | | |
| **NH)** | 6 | 2.67 (4.68) | 6 | 4.00 (5.62) | 6 | 3.00 (4.38) | 6 | 0.83 (1.33) |
| Music Therapy | 7 | 3.00 (3.22) | 7 | 10.71 (4.82) | 7 | 10.71 (6.02) | 7 | 13.86 (4.94) |
| Standard Care | | | | | | | | |
| **Wellbeing Score (DCM)** | | | | | | | | |
| Music Therapy | 5 | 0.86 (0.43) | 5 | 1.72 (0.61) | 5 | 1.80 (0.59) | 5 | 1.76 (0.48) |
| Standard Care | 7 | 1.44 (0.49) | 7 | 0.66 (0.61) | 7 | 0.61 (0.49) | 7 | 0.47 (0.68) |
| **Personal Enhancers (DCM-** | | | | | | | | |
| **PE)** | | 87.50 (17.68) | | 61.90 (53.88) | | 74.90 (31.82) | | 71.80 (19.66) |
| Music Therapy, % | | 94.45 (7.85) | | 71.90 (39.75) | | 50.90 (43.70) | | 72.50 (20.08) |
| Standard Care, % | | | | | | | | |

Figure 4.2 Mean scores for symptoms of dementia for music therapy and standard care groups

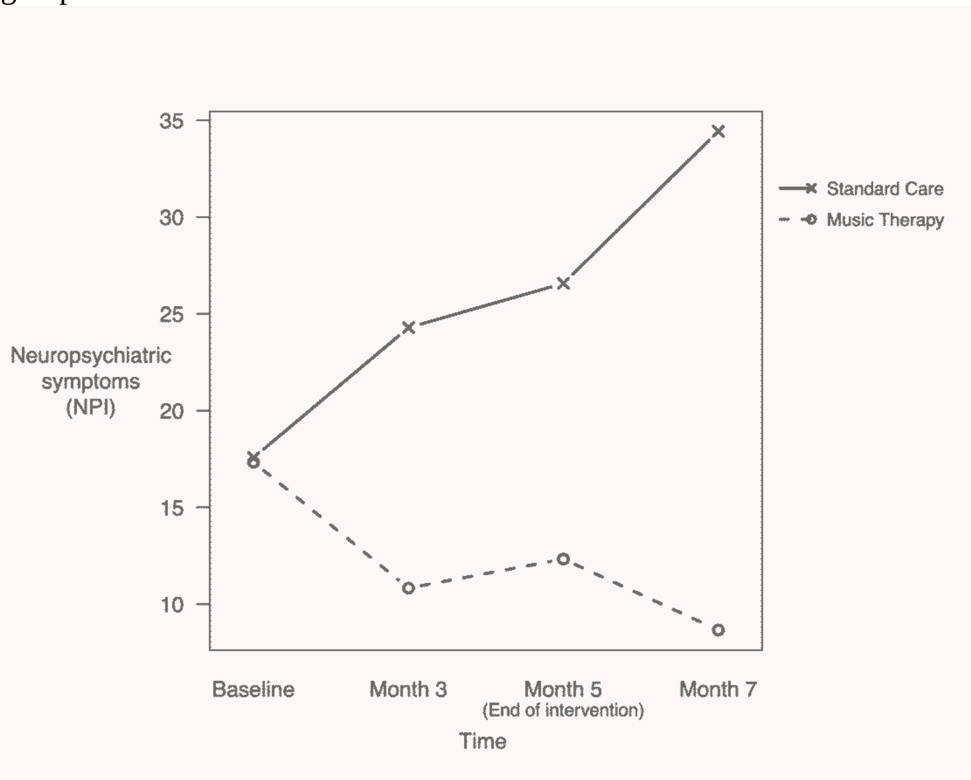



Figure 4.3 Mean scores for wellbeing levels for music therapy and standard care groups

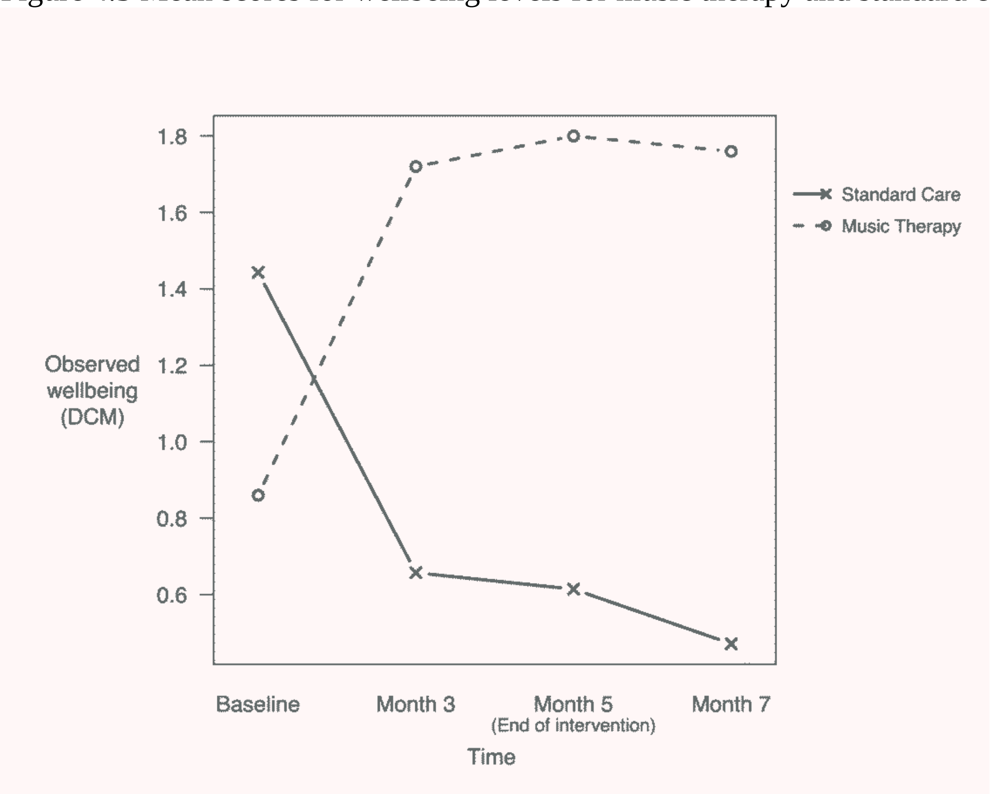



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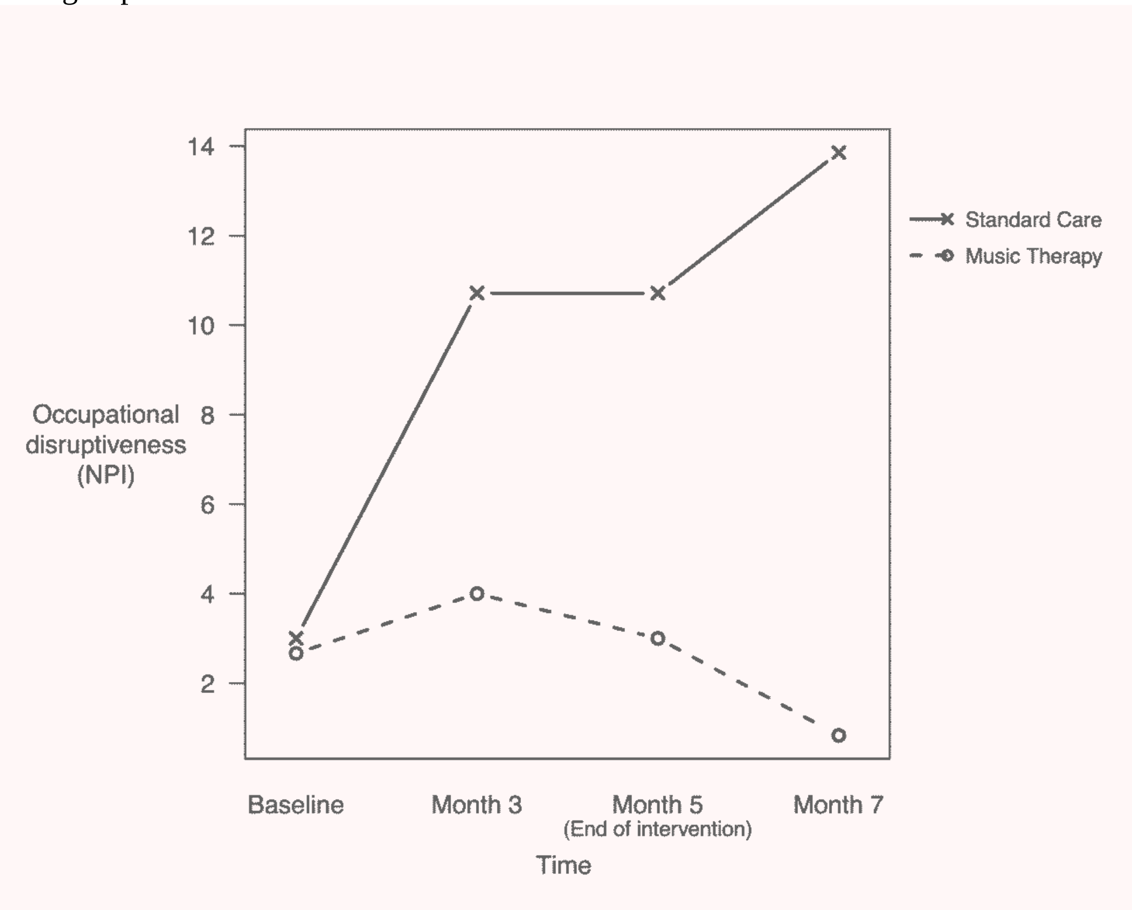
Table 4.0.3 Changes in music therapy versus standard care

| | Month 3-Baseline | | | | | | Month 5-Baseline | | | | | | Month 7-Baseline | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcome** | ***N*** | **Mean difference** | **95% Confidence Interval** | **Standard error** | **Effect size *d*** | ***p*** | ***n*** | **Mean difference** | **95% Confidence Interval** | **Standard error** | **Effect size *d*** | ***p*** | ***n*** | **Mean difference** | **95% Confidence Interval** | **Standard error** | **Effect size *d*** | ***p*** |
| **Symptoms (NPI-NH)**<br>Standard Care<br>Music Therapy | 7<br>6 | -13.21 | -24.50 to -1.93 | 5.13 | 1.44 | 0.026 | 7<br>6 | -14.00 | -24.25 to -3.76 | 4.66 | 1.69 | 0.012 | 7<br>6 | -25.52 | -39.10 to -11.95 | 6.17 | 2.32 | 0.002 |
| **Disruptiveness (NPI-NH)**<br>Standard care<br>Music Therapy | 7<br>6 | -6.38 | -11.53 to -1.23 | 1.52 | 2.34 | 0.02 | 7<br>6 | -7.38 | -11.20 to -3.57 | 1.73 | 2.39 | 0.001 | 7<br>6 | -12.69 | -18.50 to -6.88 | 2.64 | 2.69 | 0.001 |
| **Wellbeing (DCM)**<br>Standard Care<br>Music Therapy | 7<br>5 | 1.65 | 0.71 to 2.58 | 0.42 | 2.28 | 0.003 | 7<br>5 | 4.14 | 1.97 to 6.31 | 0.97 | 2.48 | 0.002 | 7<br>5 | 1.87 | 1.24 to 2.50 | 0.28 | 3.85 | <0.001 |
| **Personal Enhancers (DCM)**<br>Standard care<br>Music Therapy | | -24.08 | -97.47 to 49.32 | 17.06 | | 0.294 | | -28.08 | -86.70 to 30.55 | 13.63 | | 0.176 | | -18.83 | -37.68 to 0.026 | 4.38 | | 0.050 |

The results for the first three rows above have been obtained using the SPSS repeated measures analysis of variance procedure. The Greenhouse-Geisser statistic for checking the correlation structure is 0.85 for Symptom (NPI-NH), 0.78 for Disruptiveness (NPI-NH), and 0.82 for Wellbeing (DCM), and this has led to the decision to use the SPSS results assuming “sphericity”.

Figure 4.4 Mean scores for occupational disruptiveness for music therapy and standard care group



## 4.8 Preliminary qualitative outcomes of the semi-structured interviews

The thematic analysis of the semi-structured interviews provided insight into carers' perceptions of the music therapy programme and the video presentations. Seven carers in the music therapy group were interviewed and asked whether they felt the intervention had had an impact on the residents and/or their own caregiving.

### 4.8.1 Effect on residents

Figure 4.5 summarises staff perceptions of music therapy's effects on residents. The majority of staff (n=6) reported an observed effect on mood and emotion and sensorimotor functioning. Other effects were reported on self-expression and communication, memory, agitation, apathy, anxiety and aberrant motor behaviour. Some extracts from the interviews regarding mood and emotion and sensorimotor functioning are given below Figure 4.5.

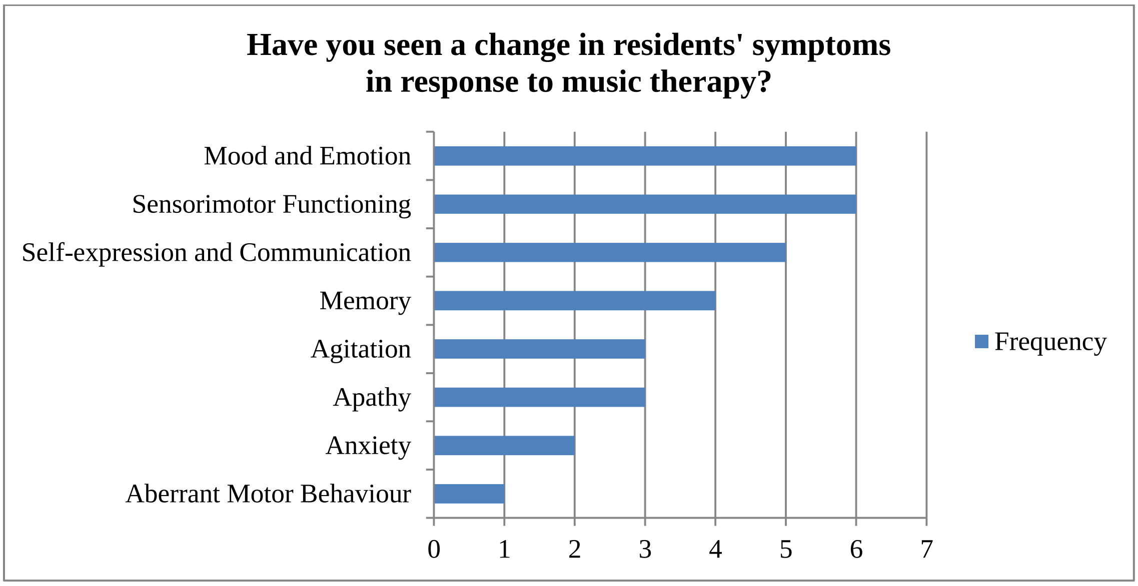



Figure 4.5 Care staff perceptions of music therapy's effect on resident

**Mood and emotion extracts**

Participant 3: 'Music therapy gives her so much joy, and obviously like, such a release of like, coming away from such noise and hectic and, you know…to somewhere actually sit down and concentrate on *her* and it's all about *her*, she really - really enjoys that.'

Participant 6: 'I don't think I've ever seen a resident go into music therapy in a bad mood and come out still in a bad mood.'

Participant 7: 'A lot of the times, it's, as I've said, quite positive. They're quite happy, quite smiley. Some residents that *wouldn't* wanna come into the dining room during a meal time, will actually *want* to come in, and engage, and *be* with everyone.'

**Sensorimotor functioning extracts**

Participant 6: 'The uh one with M [resident] tapping the drum along to… L [therapist]. Um, and L was changing the tempo of the songs, um, and then you could see M working it out and *changing tempo* with her to keep in tempo, that's a really good one.'

Participant 7: 'The banging *along* to something, right in tune, and going fast when [the therapist] was fast and going slower.'

Participant 5: 'when we [help this resident with her personal care], she just *sits* there and there's *nothing*, she'll just *stare* at you, there's just nothing- to me, there just seems nothing there, but with music you got the tappin', you know, some movement in her arm, and the odd *word* would come out.'

### 4.8.2 Effect on carers and daily practice

The music therapy presentations were delivered weekly to staff after the music therapy sessions. Figure 4.6 displays staff responses to these and their experience of the impact of the videos on their care delivery. All the staff (n=7) reported increased insight into residents, i.e. personal history, symptom causes and cognitive functioning, as a result of the presentations. Other effects included enhanced interaction techniques, altered mood and enhanced communication and relationship with residents. Some extracts are listed below Figure 4.6.

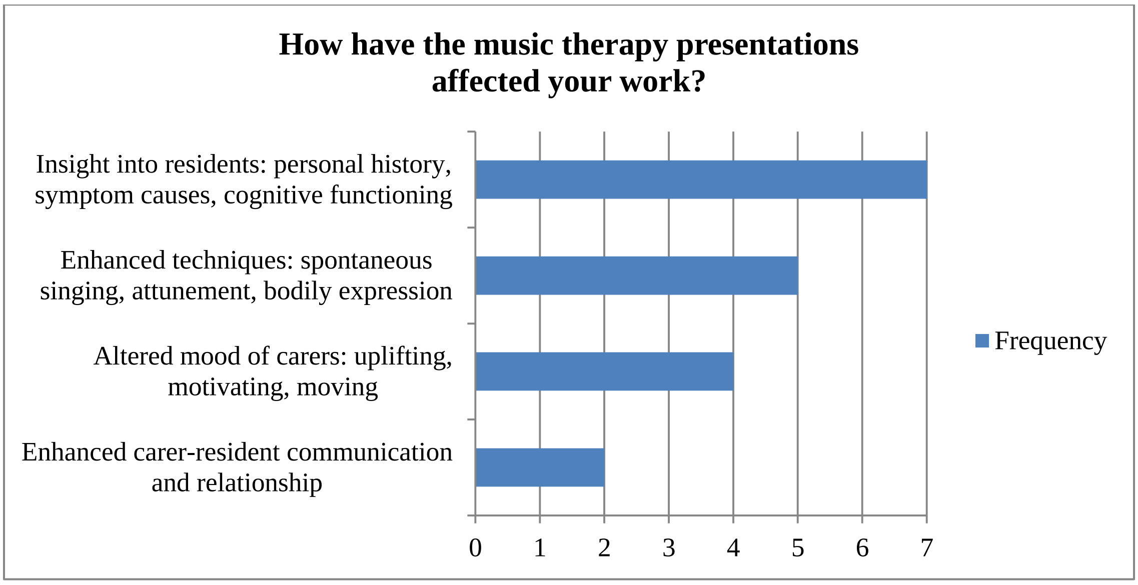



Figure 4.6 Effects of music therapy presentations on carers and their daily practice

**Insight into personal history extracts**

Participant 4: 'With… R [resident], the memories of her husband … 'cause she was talking to [the therapist] that time about that song. I think it's called *Red Sails in the Sunset* or something, and even I didn't know that about R and I was her keyworker.'

**Insight into functioning extracts**

Participant 1: 'It's very similar (*laughs*) to um, Little Britain, when he gets out of the wheelchair, when no one's looking…And runs round the block and comes back. You have to see those clips to believe, to believe that G [resident] had that rhythm, when she started with her feet and her arms, and it was like, my word, this is quiet little G that doesn't do nothing!'

Participant 4: 'Where D's [resident] *losing* that ability a bit, um, seeing those video clips just reminds you to still keep *trying*.'

**Altered mood extracts**

Participant 7: ‘It lifts your mood as well – it’s not just the resident. Like it lifts my mood, I love to see them come back from a session if they’re really smiley and happy - or to hear them sing back to me when I’m singing a song.’

**Enhanced interaction techniques extracts**

Participant 1: ‘I would be singing, saying, (*sings*) ‘We’re going to get you washed, here we go today’ and then I’d start into a song, using their name, like…(*sings*) ‘Come on then G [resident], we’re going to go G, let’s get ready and we’ll get washed’ (*laughs*). And then G would then look and she’d give a little smile. So it’s like a communication that you never knew you had.’

Participant 4: ‘Although she is *losing* that ability a little bit, sometimes a little bit… tinkering on the edge sometimes, you see the agitation *starting* to build, we will say to her, ‘Come on A [resident], play us a tune!’, and even doing this business with your fingers *(mimes playing piano)* – it will bring a smile to her face.’

Participant 4: ‘It’s not *just* about playing a tune, is it, it’s – it’s the body language.’

**Attitudes towards future training opportunities extracts**

The study also explored whether carers felt they would benefit from training workshops on music therapy techniques. Figure 4.7 provides an overview of carers’ responses. Some extracts are listed below Figure 4.7.

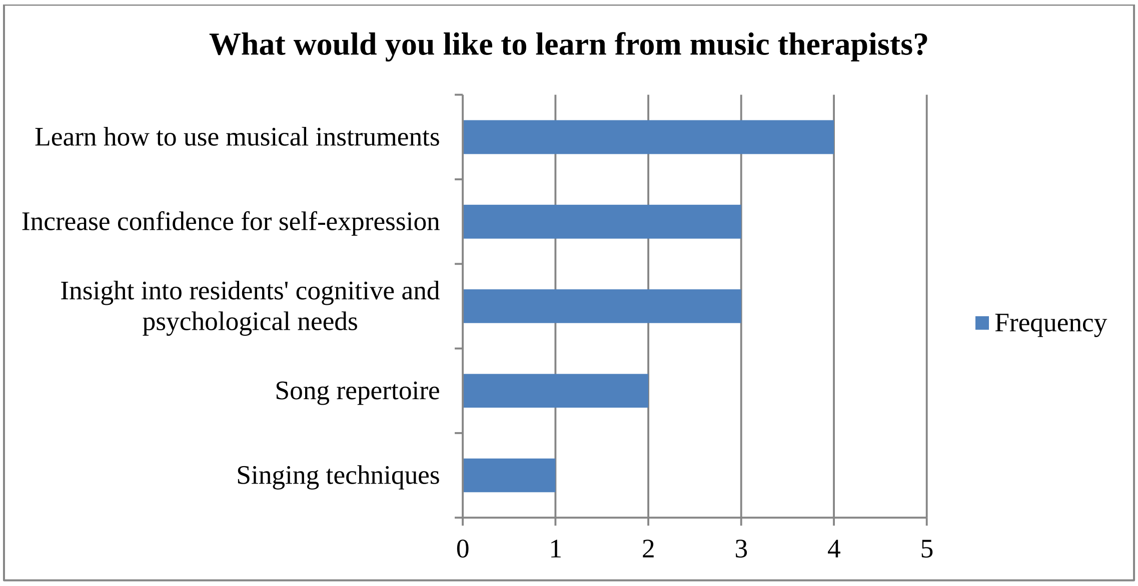


Figure 4.7 Carers' attitudes towards future training opportunities

**Learning how to use musical instruments extracts**

Participant 7: 'Do you know what, I would *love* to be able to play an instrument, I think it would be brilliant. If I could play the keyboard or something, I would always be in there playing – to sit down and do it with them, 'cause a lot of them relate to that, and a lot of them can actually do that as well.'

Participant 6: 'I'd quite like to learnt the techniques that you used to do the music therapy, I mean I know I can't play *piano*, erm, but I *can* play guitar, so it would be nice to be able to use that as a sort of transferable skill and come in and do that with the residents'

**Confidence for self-expression extracts**

Participant 1: 'To build the confidence, I mean, I'm not *too* bad, but, if there was *others*, that would just be a little bit *shy*, …self-confidence I suppose isn't it…and you'll get, you know, the *results*, er, the *response* that you're getting from it, it's *rewarding*. And that's all that matters. It doesn't matter if you look, you know, you're playing a piano that's not even there or you're (*laughs*)- you're going, you're strumming on your guitar that you haven't even got, it doesn't really matter.'

**Residents' cognitive and psychological needs**

Participant 7: 'I would love to learn to play an instrument or something, but obviously you can't teach that in a training session, but I'd love to learn what – like what you've found out from what you've done, how they react to what you've done with them.'

**Song repertoire**

Participant 6: 'It'd be nice to have, like a list of the songs that erm, *could* be used…You could *try* them with different residents. And just see what sort of reaction you get, and then you know, well maybe they like –sort of, songs from the *50's*, we'll have a look at more songs from the 50's and stuff like that.'

**Singing techniques extracts**

Participant 1: 'If someone could teach me to sing that would be quite good!'

# Chapter 5 Results: Case study A

## 5.1 Introduction

This chapter presents the results of the first case study, client A. Client A was one of the trial participants in the intervention group. The chapter begins with a discussion of A's background information. This information includes A's general appearance and manner, personal history, music preference, diagnosis, medication, neuropsychiatric symptoms, NPI and DCM outcomes, overall functioning and general process in the therapy sessions. This is followed by detailed descriptions of the 4 selected therapy sessions and the 9 video excerpts from these sessions. The method for selecting the 9 video excerpts was previously outlined in section 3.6.5 in Chapter 3. An overview of these excerpts is presented later in Table 7.4 in Chapter 7 and can be viewed via the Dropbox link. The current chapter concludes with a description of the post-therapy communication with the staff. As previously mentioned in Chapter 3 Methods, the two case studies in the thesis were designed to include both qualitative (hermeneutic analysis) and quantitative (heart rate and heart rate variability analysis) strands. However, the mixed-methods case studies were qualitative-dominant and are thus reported based on the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong, Sainsbury and Craig, 2007).

## 5.2 Background information

### 5.2.1 General appearance and manner

A is in her early nineties. She is a tall lady, who is often seen in a flowery dress with her spectacles on. There is a distinct elegant manner about her, especially when she is sitting down, reading the newspaper and drinking a cup of tea. She can also be found wandering around the unit where she resides in the care home, showing interest in objects such as the ornaments, photo frames and vases on the side or coffee tables. The way she caresses these objects by engaging her visual and tactile senses can sometimes show a glimpse of how A might have been before moving into care. In the past, she might have developed a fascination for arts or things in life that possess certain aesthetic qualities. From time to time, A can display a ruminating look with a burrowing of her brows, particularly when having been sitting down for a while without engaging in any sensory experiences. However, this can often be dispelled when a carer speaks to her and she can brighten up again with a subtle smile.

### 5.2.2 Personal history

A is known to have a daughter who appears to visit her from time to time. However, there is minimal information about A’s past regarding her occupation and family life. The care home staff have reported that there is a sense of obscurity in the relationship between A and her daughter. In A’s care plan folder, the section about her social, family and working life as well as recreation has been left blank.

### 5.2.3 Music preference

As the information about A’s past is scant, her preferences of music were identified based on staff observation. A appears to have a broad taste for music, ranging from classical, folk songs, music hall and more contemporary musical theatre. Music or songs with a prominent rhythmic feature seem to appeal to A. When music is played from the radio during lunchtime, A can be seen tapping her fingers on the table.

### 5.2.4 Diagnosis

A has a diagnosis of Alzheimer’s disease.

### 5.2.5 Medication

A has been taking an anti-depressant medication, Citalopram, (10mg daily), before and throughout the music therapy treatment course of the current study.

### 5.2.6 Neuropsychiatric symptoms

A displays the following neuropsychiatric symptoms of dementia:

Aberrant vocal noise: This seems to be a sign of discomfort for A. The volume and frequency seem to increase when A's discomfort increases and vice versa. The causes of discomfort are not clear; it could potentially be pain or tiredness.

Agitation: A's agitation may be caused by environmental factors (i.e. noise and room temperature) or social (i.e. being spoken to with raised or abrupt voice).

### 5.2.7 NPI and DCM outcomes

| | Baseline | Month 3 | Month 5 | Month 7 |
|---|---|---|---|---|
| **NPI**<br>Symptom score<br>(Frequency x Severity) | 21 | 21 | 9 | 27 |
| **DCM**<br>Wellbeing score | 1 | 1 | 2.2 | 2.2 |

Table 5.1 A's NPI and DCM outcomes

### 5.2.8 Functioning

A scores 6 on the Global Deterioration Scale (GDS). This means that she has severe cognitive decline and cannot carry out most activities of daily living without assistance. However, she retains the ability to consume meals, using a knife, fork and spoon. This indicates that A's dexterity is less impaired. A's speech production is very limited, although she may have maintained certain level of verbal comprehension. When asked with questions, she can sometimes answer with "yes" or some vocalisations, such as "hmmm" or "eh". In the music therapy sessions, as soon as the therapist starts singing or playing music, she often immediately joins in by clapping her hands, moving her legs and, at times, playing the instruments. Despite the lack of speech output, her auditory and visual perception remains very sensitive. Therefore, she is able to adjust her music playing or bodily expressions accordingly with the volume, intensity and dynamics of the therapist's music input as well as the therapist's facial, vocal and bodily expressions. Throughout the 5 months of music therapy input, it has been noticed that A seems more able to use words to respond to the therapist. She seems to use more complete and consistent phrases to answer questions than she had previously.

### 5.2.9 General process in the therapy sessions

As A is able to quickly respond to any given auditory and visual stimuli, the therapist utilises this ability of A's to increase her attention and, therefore, maximise her engagement in the therapist-client interaction during the sessions. After a few weekly sessions, the therapist has developed a format for each session. Generally, it starts with a song with a 4/4 time signature, that can generate a jazzy foxtrot style. Songs such as 'He's Got the Whole World in His Hand' and 'Happy Wonderer' are usually used to suit this purpose. The therapist will sing and play the song on the keyboard, often using his left hand to emphasise a regular beat to enable A to detect and entrain to it. During this time, A will display strong engagement by smiling, moving her hands and legs to the beat and making eye contact with the therapist. Whilst playing the keyboard, the therapist will make use of his facial, limb or trunk movements, such as swinging or rocking, to accent the beat. These visual stimuli are used to complement musical stimuli in order to activate or sustain A's entrainment of movements. Depending on A's levels of engagement, such as if A has exhibited active entraining movements, the therapist will insert an improvised section into the song. During this improvisation, he will vocalise in a way similar to a jazz scat in order to elicit an exchange of A's vocalisations. A often copies the therapist's vocalisations, but at times will improvise her own vocal phrases in response to the therapist. This allows A to utilise her vocal apparatus and, at the same time, can break down the constant vocal noises A makes. After a couple of songs, the therapist will move the snare drum, cymbal and wind chimes in front of A and offer her a drum stick to play these instruments alongside the therapist's keyboard playing. Playing these instruments enables A to access her remaining ability in coordinating hand and arm movements, which indicates A's level of dexterity. Whilst interacting with A musically, the therapist also monitors A's residual abilities, including entraining movements, response time and intensity of entrainment, vocal sound production and dexterity. This allows the therapist to establish which abilities may still be accessible and which stimuli may help access these abilities.

In the early sessions during the study, the therapist employed the upbeat foxtrot style in playing or singing every song as he felt that this method could maintain A's engagement throughout a session. Furthermore, he often tried to increase A's engagement to an optimal level by finishing a session with a fast-tempo and energetic song. However, on several occasions, the therapist noticed that this method may have resulted in A's tiredness and the associated irritability immediately after the sessions; A could display verbally or physically agitated behaviours when the care staff escorted her back to the lounge. Due to this observation, the therapist realised that he would need to induce levels of relaxation during the sessions. Therefore, as soon as A has reached a high level of active engagement, the therapist gradually introduces songs in a ¾ waltz style, such as 'Whatever Will Be, Will Be' and 'Are You Lonesome Tonight'. When these songs are introduced, A's entraining movements slow down accordingly. The therapist can further slow down the waltz to induce an optimal level of relaxation. As the therapist plays and sings with a legato style with a softened timbre, A often sits back to listen calmly and shows a thoughtful look. At the end of the concluding song, she often smiles at the therapist, which may indicate her appreciation and enjoyment.

The above description has outlined a general format, which the therapist has developed and implemented in A’s sessions. The following section will provide further details of the specific events in A’s therapy by illustrating the 4 videoed sessions (see Table 3.2) and the 9 video excerpts (see Table 7.4) extracted from these sessions.

## 5.3 Description of the 4 therapy sessions and 9 selected video excerpts

### 5.3.1 Session 15 incl. video excerpt 1 and 2

At the beginning of the session, A was sitting in an arm chair and producing her usual vocal noises. However, she appeared pleasant in mood, showing no signs of agitation. From the outset of the session, the therapist employed the usual therapy format, starting with singing and playing upbeat songs, such as ‘Show Me the Way to Go Home’, and moving on to engaging A in playing the drum and cymbal. The session then gradually moved to a conclusion, with the therapist playing waltz songs such as ‘My Bonnie Lies over the Ocean’. A’s vocal noises immediately stopped as her attention was drawn to the musical beat and the therapist’s expressions. The vocal noises remained absent during most of the session, especially when A was engaged in listening to or playing along with the therapist’s songs. During these times, A was often smiling, looking at the therapist and either clapping actively or putting her hands together to tap the beat on her lap. The therapist occasionally inserted an improvised section, based on the motif of the familiar songs used. Whilst improvising, he would speed up the tempo and use a more percussive timbre to catch A’s attention, particularly when A appeared to become less engaged.

Figure 5.1 below is extracted from the video coding of the four types of expressions, including mixed, verbal, nonverbal and musical. It reflects how the therapist and A spent their time in session 15. In this 30 minute session, the therapist spent 1462 seconds (24 minutes) on engaging A with his musical expressions. A also spent 958 second (15 minutes) on her musical expressions. There was also some time during the session when the therapist and A engaged in verbal and nonverbal expressions. One special event was recorded, as there was 1 second when A turned her head to the member of staff who entered the therapy room to retrieve some documents.

Figure 5.1 A and the therapist's time (seconds) spent on various expressions in session 15

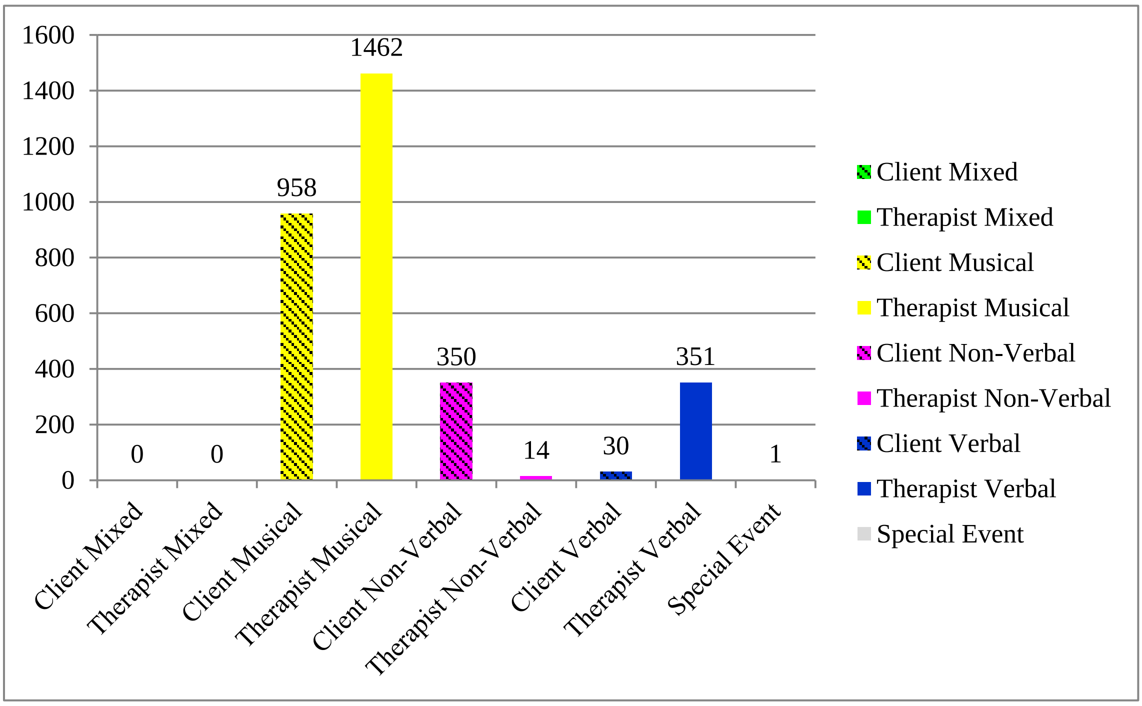
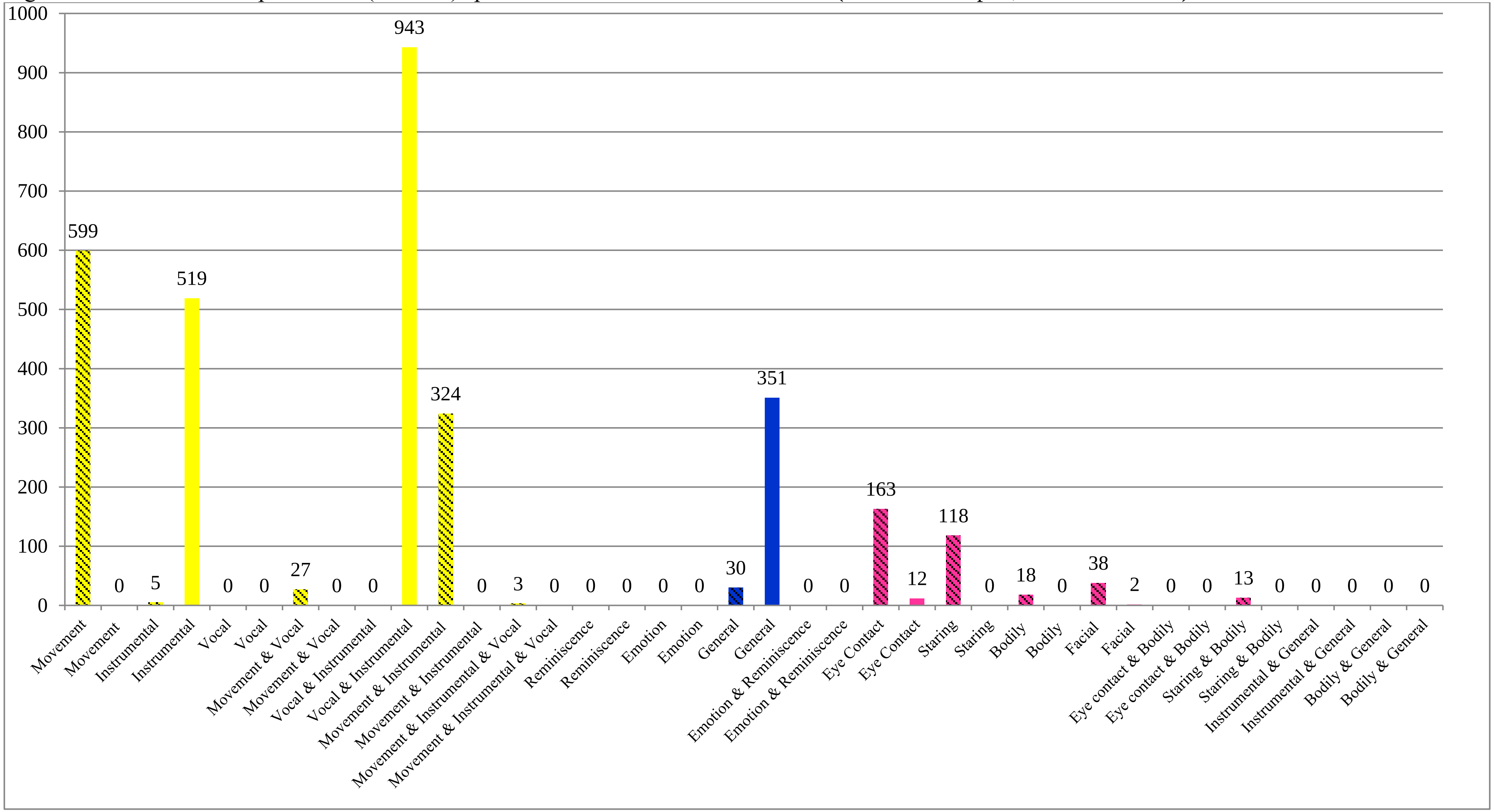



Figure 5.2 breaks down the expressions outlined in Figure 5.1 into single or combined types of action. This shows that the therapist's musical expressions, lasting 1452 seconds, involved him playing the keyboard to A (519 seconds) and singing songs with keyboard accompaniment (943 seconds). A's musical expressions (958 seconds) in response to the therapist's inputs consisted of 599 seconds of entraining movements, 324 seconds of  instrument playing with her coincident entraining movements, 27 seconds of vocalisation alongside her entraining movements,  5 seconds of solely instrument playing and 3 seconds of vocalisation alongside both instrument playing and entraining movements. Within verbal expressions, this mostly involved the therapist and A engaging in some general conversations. Within nonverbal expressions, A used a lot

of eye contact, staring, body movements, unrelated to the musical beat and staring with coincident body movements. As for the therapist, he appeared to use his facial expressions and eye contact to communicate at times when he was not playing the keyboard or singing.

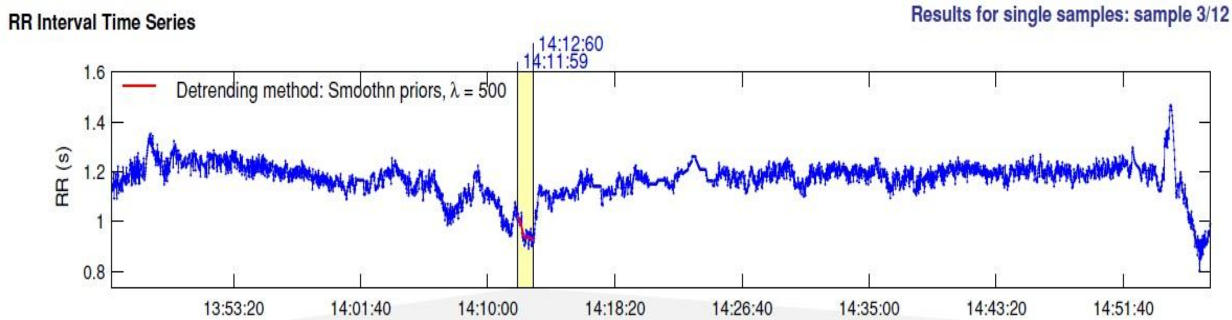
Figure 5.2 A and the therapist's time (seconds) spent on various actions in session 15 (Solid = Therapist, Hashed = Client)



### 5.3.2 Video excerpt 1: Entraining to 4/4 time

In session 15, 2 video excerpts were selected based on the results of the heart rate analysis (see Table 7.4). The first excerpt started from 6 minutes and 7 seconds into the session. In Figure 5.3 below, the blue line shows A's RR interval time series throughout the pre-therapy baseline period, the therapy session and the post-therapy data collection period. Video excerpt 1 took place between the real time of 14:11:59 and 14:12:60 on 4th July 2013, which is highlighted in yellow. The red line within this real time segment is the RR interval after the removal of artefacts from the raw data.

Figure 5.3 A's RR interval time series during video excerpt 1




In this excerpt, A initiated her hand clapping and the therapist took the opportunity to incorporate this into his playing of the 'Hokey Cokey' song on the keyboard. He also vocalised for about 4 seconds towards the end of his playing. In response to the therapist's music playing and bodily expressions, A displayed active movements by clapping her hands and focusing her gaze at the therapist. She was clearly able to detect the beat interval and, therefore, continued to clap her hands. A also exhibited the ability to adjust her clapping by only clapping on the strong beat when the therapist slowed down his playing during the final cadence of the song. The therapist could be seen using certain bodily expressions to cue the cadence. These bodily expressions included his stooping down towards the keyboard when quietening his playing and emphasising his slowed down right hand/arm movements when playing the last 3 notes of the melody line of the cadence.

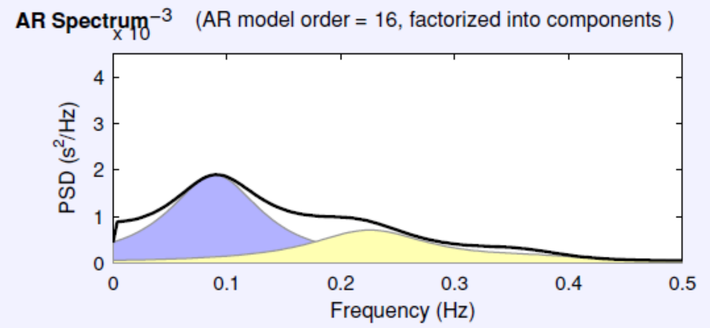
The therapist started ‘Hokey Cokey’ with a tempo initially at 138 beats per minute (bpm) but later increased this to 141bpm before slowing down to 110 bpm during the cadence.  Figure 5.3 above shows that this 2 minute video excerpt captured the time when A’s RR interval dropped to the lowest point during the session. A’s mean RR was 952.7 ms and mean HR was 63.06 beat bpm during this excerpt (Table 5.2). Before ‘Hokey Cokey’, A’s mean RR was 1058.5 ms and mean HR 56.91 bpm whilst the therapist was singing and playing the song ‘You Are My Sunshine’ (see Time-Domain Results on p.73 in Appendix 9), which started with a tempo 124 bmp and later increased to 134 bpm. This shows that as the therapist continued to speed up the tempo between ‘You Are My Sunshine’ and ‘Hokey Cokey’, A’s heart rate gradually increased whereas her RR intervals decreased. A’s relative HF power during ‘You Are My Sunshine’ was 66.7% (see Frequency-Domain Results: AR Spectrum on p.73 in Appendix 9) but this dropped to 36.1% during ‘Hokey Cokey’ (Figure 5.4). This indicates that the parasympathetic nervous activity decreased whilst sympathetic nervous activity became dominant as the therapist continued to increase the tempo between the two songs.

Table 5.2 Indices of A’s HR and HRV during video excerpt 1

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 952.7 |
| STD RR (SDNN) | (ms) | 19.5 |
| Mean HR* | (1/min) | 63.06 |
| STD HR | (1/min) | 1.61 |
| RMSSD | (ms) | 20.2 |
| NN50 | (count) | 1 |
| pNN50 | (%) | 1.6 |
| RR triangular index | | 6.400 |
| TINN | (ms) | 80.0 |

Figure 5.4 A’s LF and HF powers during video excerpt 1




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0898 | 249 | 63.9 | 63.9 |
| HF (0.15–0.4 Hz) | 0.2266 | 140 | 36.1 | 36.1 |
| Total | | 389 | | |
| LF/HF | | 1.772 | | |

### 5.3.3 Video excerpt 2: Calming ¾ time

The second excerpt was selected because A displayed a low mean SDNN during the excerpt (Table 7.4). The excerpt was 16 minutes 50 seconds into session 16 and took place between 14:22:42 and 14:24:18 in real time (Figure 5.5). During this excerpt, lasting 1 minute 40 seconds, the therapist was playing and singing ‘The Ash Grove’ (3/4 time signature) at a tempo around 98 bpm, which dropped to 86 bpm during the cadence. During this time, A appeared calm and settled in mood. She was sitting back and listening to the therapist’s singing and playing. Whilst concentrating on the music listening, she displayed a thoughtful facial expression but at times established eye-contact with the therapist. The therapist reduced the texture of his keyboard accompaniment to allow his singing to stand out. He also softened his vocal timbre to produce legato singing and clearly quietened his singing during the cadence of the song. At the end of excerpt, A showed a smile and made eye contact with the therapist.

Figure 5.5 A’s RR interval time series during video excerpt 2

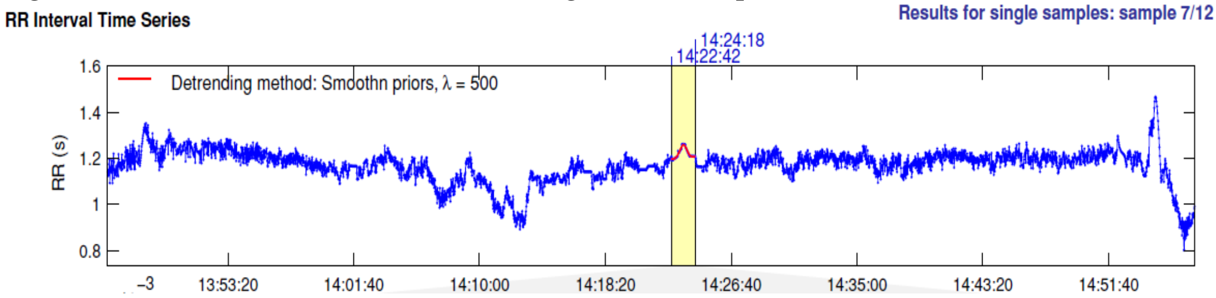


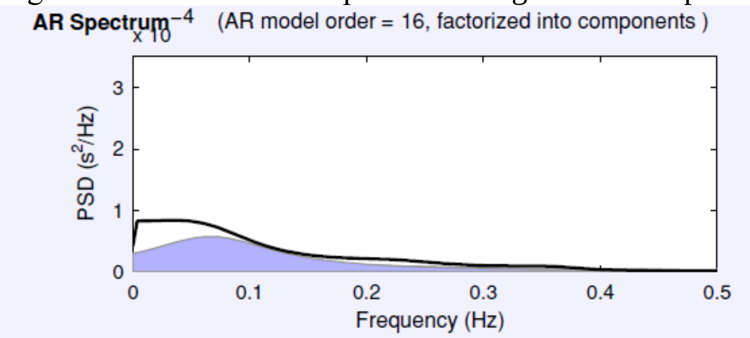

Figure 5.5 above shows that A’s RR interval time series peaked in the middle of the excerpt (red line within the yellow section). Her mean RR during this segment was 1221.7 ms (see Table 5.3), which had increased from 1159.8 ms during the preceding musical interaction (see Time-Domain Results on p.77 in Appendix 9). This preceding segment involved the therapist engaging A in playing the drum and cymbal whilst he sang and played the song ‘Bye Bye Blackbird’, which started at a tempo of 124bpm, increased to 126bpm and then decreased to 73bpm at the cadence. A’s mean HR decreased from 51.75 bpm during ‘Bye Bye Blackbird’ (see Time-Domain Results on p.77 in Appendix 9). to 49.13 bpm during ‘The Ash Grove’ in excerpt 2. Her heart rates appeared to be less changeable throughout the excerpt, as indicated by the heart rate standard deviation (0.71 bpm) (Table 5.3). Figure 5.6 shows that the sympathetic nervous activity dominated throughout the excerpt, as indicated by the relative LF power (58.4%).

Table 5.3 Indices of A’s HR and HRV during video excerpt 2

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1221.7 |
| STD RR (SDNN) | (ms) | 3.9 |
| Mean HR* | (1/min) | 49.13 |
| STD HR | (1/min) | 0.71 |
| RMSSD | (ms) | 3.8 |
| NN50 | (count) | 0 |
| pNN50 | (%) | 0.0 |
| RR triangular index | | 1.519 |
| TINN | (ms) | 15.0 |

Figure 5.6 A’s LF and HF powers during video excerpt 2




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 6 | 41.6 | |
| LF (0.04–0.15 Hz) | 0.0664 | 9 | 58.4 | 100.0 |
| HF (0.15–0.4 Hz) | 0.0000 | 0 | 0.0 | 0.0 |
| Total | | 16 | | |
| LF/HF | | Inf | | |

### 5.3.4 Session 16 incl. video excerpt 3, 4 and 5

At the beginning of the session, A appeared slightly sleepy, sitting in the arm chair and producing her usual vocal noises. However, she seemed to perk up as the therapist spoke to her and she stopped making the vocal noises. The therapist followed the same format, starting with a 4/4 upbeat song ‘He’s Got the Whole World in His Hands’. Later on, he encouraged A to play the metallophone by showing her how to using the mallets. A then started to explore the sound of the notes on the metallophone with the mallets in both hands. However, she stopped playing and appeared to focus on listening to the therapist as soon as he started improvising on the keyboard. Towards the end of the session, A fell asleep whilst the therapist was singing and playing ‘The Ash Grove’.

Figure 5.7 below shows that both the therapist and A spent the most time on their musical expressions in session 16. The therapist spent 1404 seconds (23 minutes) and A spent 883 seconds (15 minutes) on musical interactions during this 30 minute session. As usual, some verbal and nonverbal expressions were also observed during the session. There were 11 seconds during the session when the therapist displayed mixed expressions. Figure 5.8 below shows that these mixed expressions involved the therapist in general conversations and instrument playing where he modelled how to play the metallophone in order to encourage A to play and when he verbally responded to A's verbalisation whilst playing the keyboard.

Figure 5.8 also shows that within the musical expressions, the therapist employed 588 seconds of solo singing and 761 seconds of singing with keyboard accompaniment. As for A, her musical expressions were predominantly expressed by entraining movements (716 seconds). There were 113 seconds where A engaged in instrument playing. The therapist and A also communicated verbally through general conversations, although A's verbalisation remained minimal (26 seconds). Nonverbally, A employed eye contact (68 seconds), staring (91 seconds), non-musical body movements (16 seconds) and facial expressions (14 seconds).

Figure 5.7 A and the therapist's time spent on various expressions in session 16

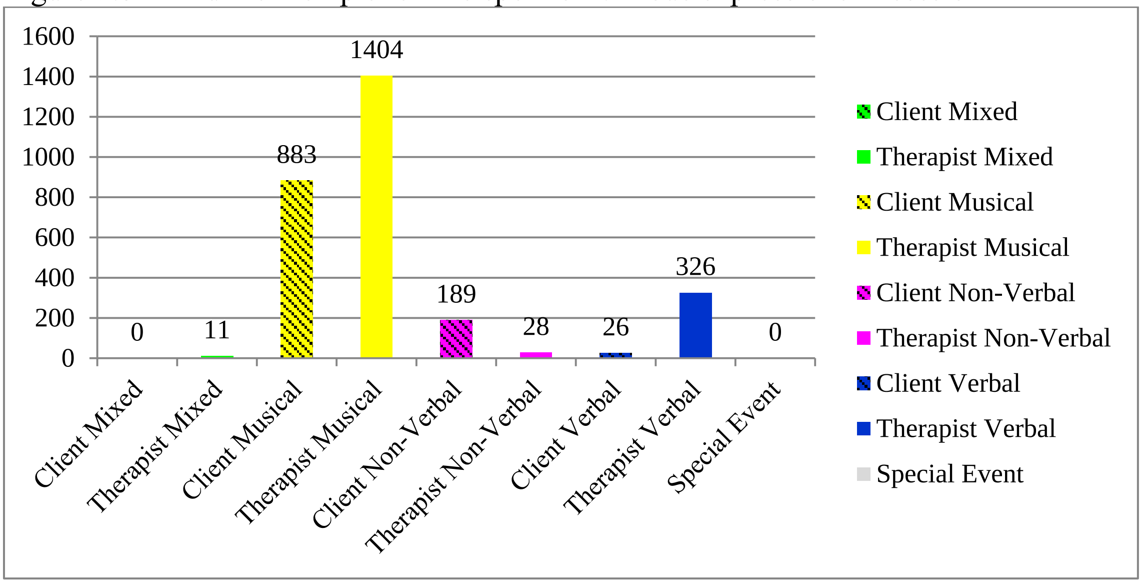
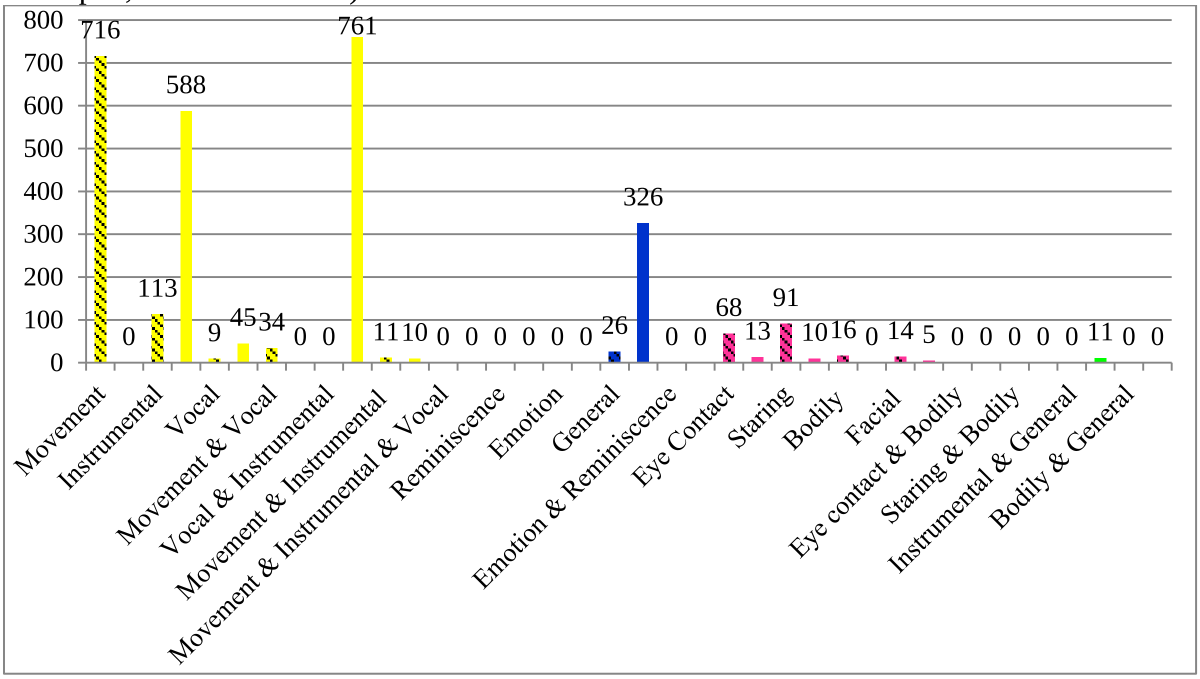


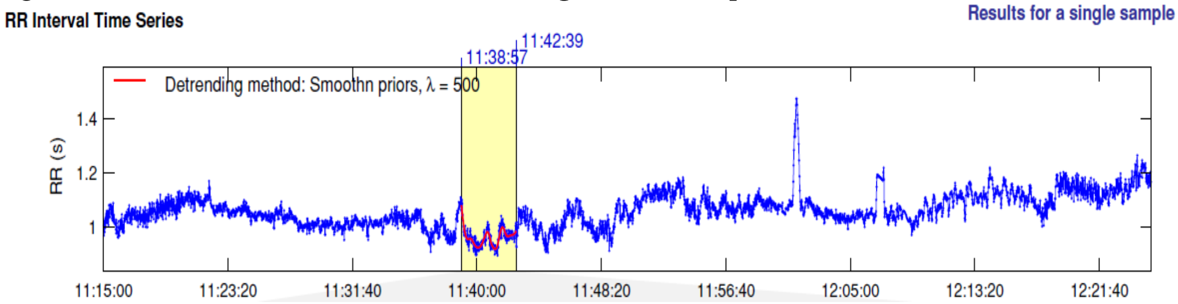
Figure 5.8 A and the therapist's time spent on various actions in session 16 (Solid = Therapist, Hashed = Client)



### 5.3.5 Video excerpt 3: Call and response

This excerpt is the first of three excerpts selected from session 16. In figure 5.9 below, the time segment between 11:38:57 and 11:42:39 in real time is longer than the actual length of video excerpt 3. This long excerpt was shortened to 3 minutes 20 seconds in order to ensure the cognitive psychologist's and music therapist's observation focused on the prominent features of the therapist-client interaction. Therefore, the excerpt covers the real time from 11:39:19 to 11:42:45, which includes the 6 seconds of A's response after the therapist finished his music playing. The excerpt was selected as A's heart rates appeared fairly changeable during the video. This was indicated by a high mean HR standard deviation (see Table 7.4).

Figure 5.9 A's RR interval time series during video excerpt 3




In this excerpt, the therapist was singing and playing the song 'Little Brown Jug'. His tempo increased and decreased at various points during the excerpt. Generally, the tempi ranged from between 123 bpm and 130 bpm before the cadence, which eventually slowed down to around 109 bpm. In response to the therapist's visual and auditory inputs, A was smiling at the therapist, singing along and either clapping her hands or moving her arms up and down to entrain to the musical beat. As the therapist increased the volume and used a staccato timbre to accent the beat, A appeared to be able to pick up on this change in music, increasing her energy level in her hand clapping and other movements. Later on, the therapist inserted a couple of improvised sections based on the motif of the song. These improvisations all had an increased tempo and led to short "call and response" sections, where the therapist initiated and repeated a clear rhythmic pattern on the keyboard and paused for A to respond. It is noteworthy that 1 minute and 53 seconds into the video, the therapist used vocalisations to elicit A's response; A started to vocalise but then the vocalisation seemed to transition into the aberrant vocal noises she usually made. She also appeared to lose her concentration and turned her head away from the therapist. As the therapist completely stopped his keyboard playing at 2 minutes 8 seconds to solely use vocalisations, A also stopped her hand clapping and remained slightly preoccupied and focused her gaze away from the therapist.

Table 5.4 below shows that during the excerpt A's mean RR was 959.6 ms, which decreased from 982.3 ms (see Time-Domain Results on p.85 in Appendix 10) in the beginning of the session, when the therapist engaged A with the song 'He's Got the Whole World in His Hands'. During the excerpt (see Table 5.4), A's RR intervals appeared to be changeable as indicated by the standard deviation (SDNN) (18.7 ms). Furthermore, her mean HR (62.61 bpm) and HR standard deviation (1.79 bpm) reached the highest point of the session during the excerpt. This indicates that her heart rates were high and most variable throughout the excerpt.

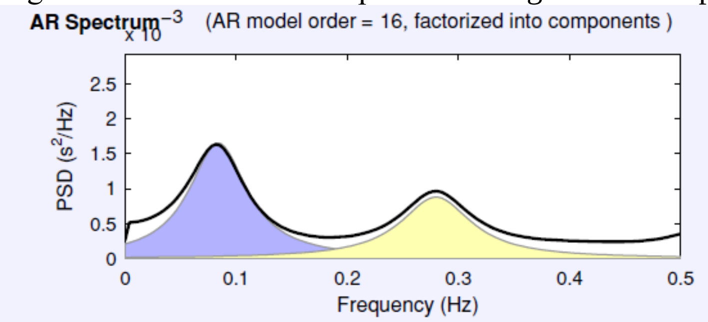
Table 5.4 Indices of A's HR and HRV during video excerpt 3

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 959.6 |
| STD RR (SDNN) | (ms) | 18.7 |
| Mean HR* | (1/min) | 62.61 |
| STD HR | (1/min) | 1.79 |
| RMSSD | (ms) | 25.4 |
| NN50 | (count) | 13 |
| pNN50 | (%) | 5.7 |
| RR triangular index | | 5.775 |
| TINN | (ms) | 95.0 |

Figure 5.10 below shows that A's raised heart rate received more influence from the sympathetic nervous system (relative LF power 46.9%) than the parasympathetic nervous system (relative HF power 32.7%).

Figure 5.10 A's LF and HF powers during video excerpt 3

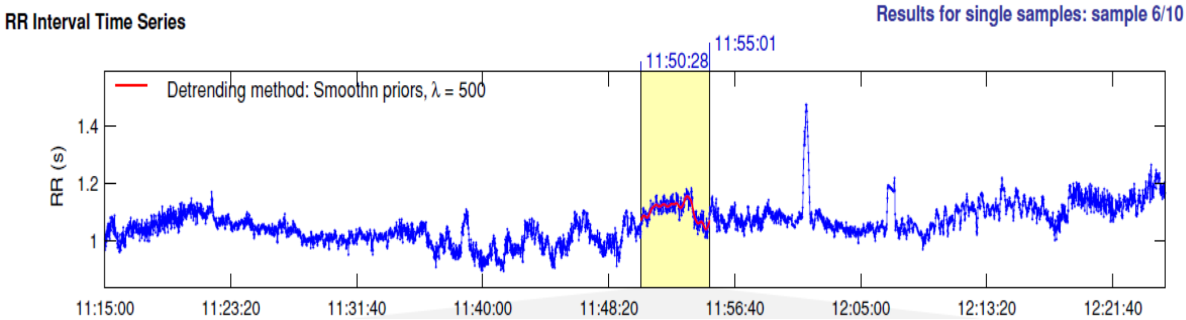



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0820 | 147 | 46.9 | 46.9 |
| HF (0.15–0.4 Hz) | 0.2813 | 102 | 32.7 | 32.7 |
| Total | | 314 | | |
| LF/HF | | 1.435 | | |

### 5.3.6 Video excerpt 4: Improvisation

This excerpt was selected as an additional excerpt for A as it is the only video that shows her engagement in improvisation on a melodic instrument, a metallophone. The time segment in Figure 5.11 is a very long sequence of joint improvisation between 11:50:28 and 11:55:01 in real time. Therefore, the actual video used for the cognitive psychologist and music therapist's video analysis was shortened to 3 minutes 17 seconds (between 11:50:28 and 11:53:45 in real time).

Figure 5.11 A's RR interval time series during video excerpt 4




During the video excerpt, the therapist was improvising on the keyboard. He produced a soothing effect by using the sustain pedal and playing a generally downward melodic contour on the lower end of the keyboard. However, a regular beat was still emphasised at an initial tempo of 71 bpm (i.e. andante moderato). This was gradually increased to 78 bpm (i.e. andantino), the fastest tempo used before coming back down to 72 bpm towards the end of the excerpt. During this time, A was able to play the metallophone on her own accord. However, her vocal noises gradually appeared, particularly during the moment when she paused her playing and directed her gaze to the therapist. The therapist then encouraged A to continue playing by reaching out his right hand to play a few notes on the metallophone. In order to divert A from making vocal noises, the therapist vocalised a line as an auditory stimulus in an attempt to change A's vocal noises into melodic vocalisations. However, A's vocal noises continued intermittently throughout. 56 seconds into the excerpt, A appeared to be counting numbers whilst staring at the keyboard. During the improvisation, the therapist found it difficult to sustain A's attention in order to minimise her vocal noises. As a result, he tried to introduce various visual and musical stimuli, such as using an accented beat, increasing volume and tempo on the keyboard, physically modelling on the metallopone and using his verbal prompt or vocalisations, to capture A's attention.

Table 5.5 below shows that A's mean RR was 1104.60 ms and mean HR was 54.38 bpm during this excerpt. Comparing these figures to the preceding musical interaction (see Time-Domain Results on p.88 in Appendix 10) indicates that the improvisation increased A's mean RR from 995.4 ms and decreased her mean heart rate from 60.34 bpm. In the previous time segment (between 11:46: 51 and 11:49:04) (see Time-Domain Results on p.88 in Appendix 10), the therapist played and sang 'Yellow Submarine' during which his tempi were much faster (between 116 and 119 bpm) than during the improvisation. A also responded to the accented beat of this song with active hand clapping and leg movements.

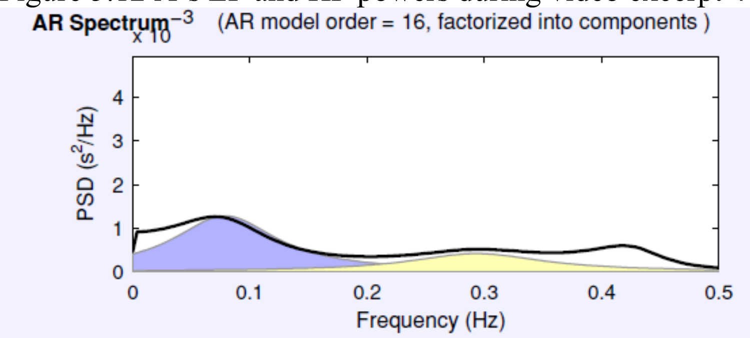
Table 5.5 Indices of A’s HR and HRV during video excerpt 4

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1104.6 |
| STD RR (SDNN) | (ms) | 18.7 |
| Mean HR* | (1/min) | 54.38 |
| STD HR | (1/min) | 1.19 |
| RMSSD | (ms) | 26.3 |
| NN50 | (count) | 10 |
| pNN50 | (%) | 4.1 |
| RR triangular index | | 5.744 |
| TINN | (ms) | 90.0 |

The improvisation also appeared to increase A’s LF/HF ratio to 2.121 (Figure 5.12) from 1.243 displayed during the song ‘Yellow Submarine’ (see Frequency-Domain Results: AR Spectrum on p.88 in Appendix 10). The LF/HF ratio 2.121 (during the improvisation) was the highest value throughout session 17, which indicates that the improvisation maximised the sympathetic nervous activity.

Figure 5.12 A’s LF and HF powers during video excerpt 4

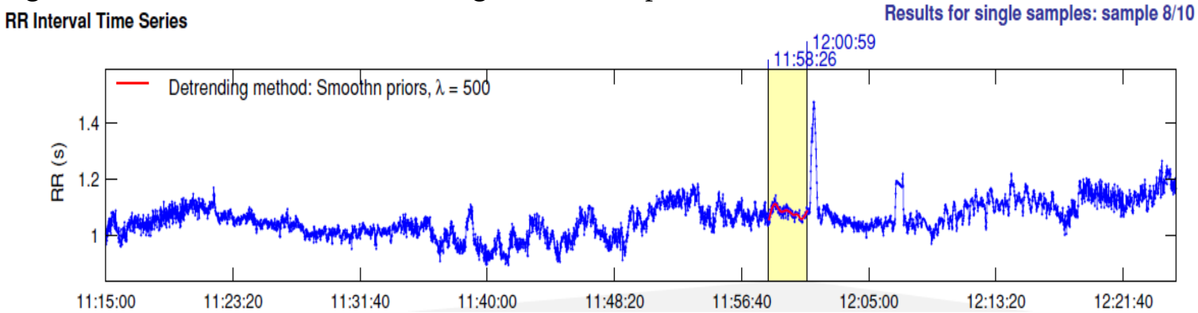



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0781 | 176 | 56.8 | 56.8 |
| HF (0.15–0.4 Hz) | 0.2930 | 83 | 26.8 | 26.8 |
| Total | | 309 | | |
| LF/HF | | 2.121 | | |

### 5.3.7 Video excerpt 5: From receptive listening to entraining movements

Excerpt 5 (the yellow section in Figure 5.13) was the second time segment after the improvisation. Between excerpt 4 and 5, the therapist improvised on the keyboard in a Yiddish folk style in A minor whilst A listened and moved her legs and hands to the beat. During this improvisation, A's mean HR slightly increased (56.01 bpm) (see Time-Domain Results on p.90 in Appendix 10), and LF/HF ratio (0.850) (see Frequency-Domain Results: AR Spectrum on p.90 in Appendix 10), decreased to indicate an increase in parasympathetic nervous activity. Following on from this upbeat improvisation, the therapist engaged A with the song 'Early One Morning' throughout excerpt 5 (Figure 5.13). The therapist initially started the song with a tempo of 56 bpm and used a softened singing voice to generate a calming and tender feeling. A appeared to be sitting calmly, listening receptively and generally staring straight in front of her.

Figure 5.13 A's RR time series during video excerpt 5



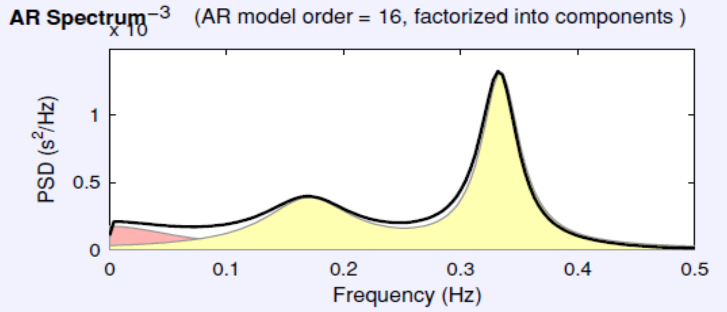

1 minute and 22 seconds into excerpt 5, the therapist sped up the song and used a percussive timbre and a foxtrot style. At this time, the music seemed to activate A's leg and hand movements along to the beat and the tempo gradually reached 74 bpm before slowing down towards the end of the song. A appeared to concentrate on listening whilst displaying subtle entraining movements. At the end of the excerpt, she seemed thoughtful and settled in mood. Table 5.6 shows that there were no significant changes in A's HR and HRV during excerpt 5; compared with excerpt 4. However, in excerpt 5 her relative HF power drastically increased to 86.7%, which indicated the dominance of the parasympathetic nervous activity (Figure 5.14).

Table 5.6 Indices of A's HR and HRV during video excerpt 5

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1082.1 |
| STD RR (SDNN) | (ms) | 11.1 |
| Mean HR* | (1/min) | 55.46 |
| STD HR | (1/min) | 0.80 |
| RMSSD | (ms) | 16.8 |
| NN50 | (count) | 0 |
| pNN50 | (%) | 0.0 |
| RR triangular index | | 3.279 |
| TINN | (ms) | 50.0 |

Figure 5.14 A's LF and HF powers during video excerpt 5




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 20 | 13.3 | |
| LF (0.04–0.15 Hz) | 0.0000 | 0 | 0.0 | 0.0 |
| HF (0.15–0.4 Hz) | 0.3359 | 128 | 86.7 | 100.0 |
| Total | | 148 | | |
| LF/HF | | 0.000 | | |

### 5.3.8 Session 17 incl. video excerpt 6 and 7

Session 17 presents again the general process in A's therapy when A and the therapist engaged mostly in musical expressions (Figure 5.15). 3 special events were marked during the session. The first mark was at 7 minutes 23 seconds into the session: the therapist introduced his rhythmic vocalisation whilst improvising on the keyboard and A started copying this vocalisation. Before this point, A was clapping her hands and making eye contact with the therapist. The second and third special event marked the time between 13 minutes 06 seconds and 13 minutes 55 seconds when the session was interrupted when a resident in a wheelchair was pushed by his relative through the therapy room in order to gain access to the garden.

Figure 5.16 breaks down the expressions outlined in Figure 5.15. Within A's musical expressions, she used a lot of movements (611 seconds) and also played the drum whilst tapping her feet (197 seconds). These might be the responses to the therapist's singing (602 seconds) and singing whilst playing the keyboard (725 seconds).

Figure 5.15 A and the therapist's time (seconds) spent on various expressions in session 17

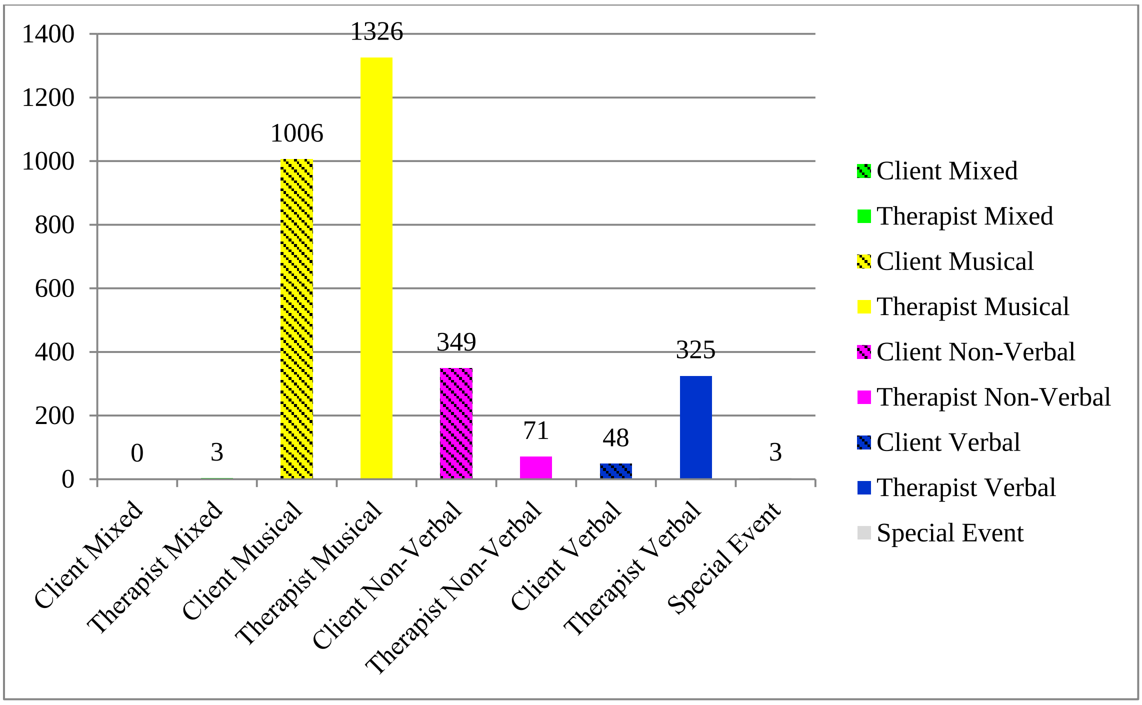
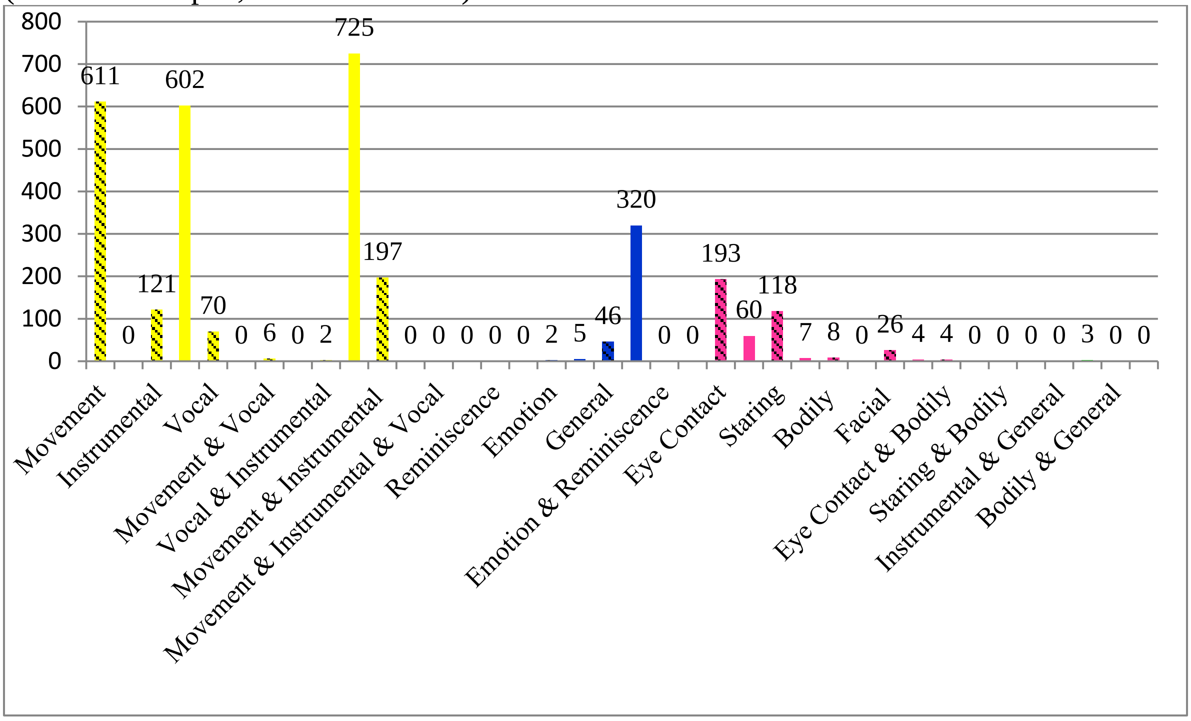


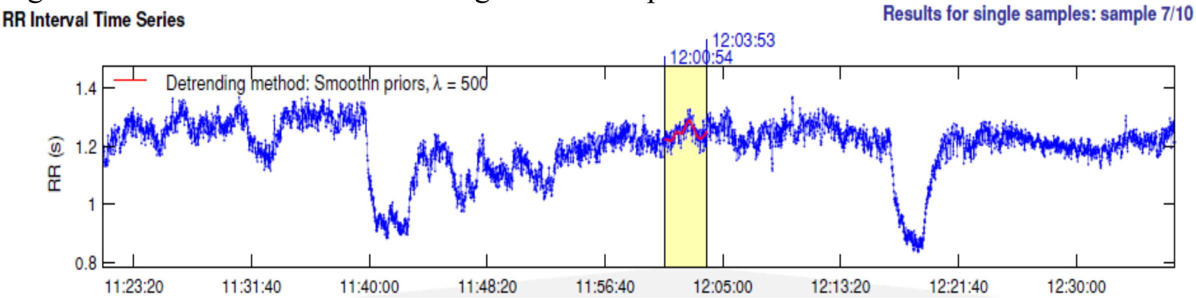
Figure 5.16 A and therapist's time (seconds) spent on various actions in session 17 (Solid = Therapist, Hashed = Client)




### 5.3.9 Video excerpt 6: Receptive listening to improvised singing and keyboard playing

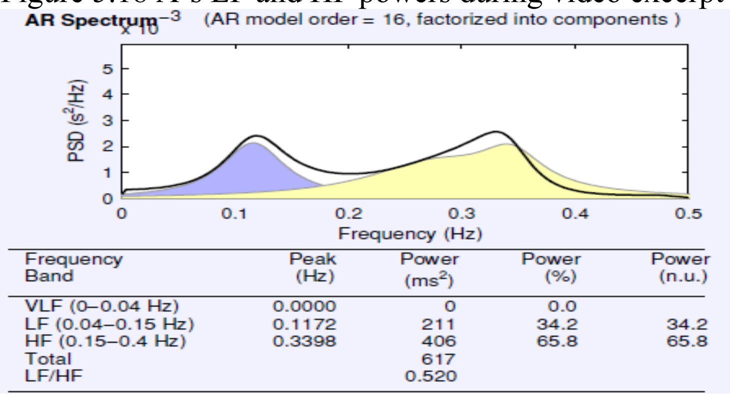
In this excerpt, the therapist was improvising a melody on the keyboard and vocalising similarly to his improvisation in Excerpt 4. The tempo started at 81 bpm (i.e. andantino) but gradually slowed down to 71 bpm (i.e. andante moderato) as A's vocal noises slowly arose to match the pitch of the music. From the beginning of the excerpt, A seemed to be distracted by her surroundings, turning her head away from the therapist. 18 minutes 28 seconds into the session, A turned her head to establish eye contact with therapist. The therapist then took the opportunity to accent the beat on the keyboard. This appeared to result in A hitting the beaters together to the beat. When A's attention was drawn to the beat by hitting the beaters together, her vocal noises stopped. During this time the therapist stopped his vocalisation and increased the tempo of the music to around 78 bpm (i.e. andantino). As the tempo showed a V shape sequence (Fast-Slow-Fast), A's RR interval seemed to increase and displayed generally an inverted V (low-high-low) (the red line in Figure 5.17). It is noteworthy that towards the end of the excerpt, the therapist vocalised during the cadence, which appeared to activate A’s vocal noises again. A’s vocal noises then continued after the therapist had finished playing the music.

Figure 5.17 A’s RR time series during video excerpt 6




During excerpt 6, A’s mean RR interval increased to 1244.7 ms (see Time-Domain Results on p.101 in Appendix 12), which was higher than the time segments before (see Time-Domain Results on p.100 in Appendix 12) and after this excerpt (see Time-Domain Results on p.102 in Appendix 12). A’s relative HF power also showed a parasympathetic dominance (65.8%) (Figure 5.18).

Figure 5.18 A’s LF and HF powers during video excerpt 6

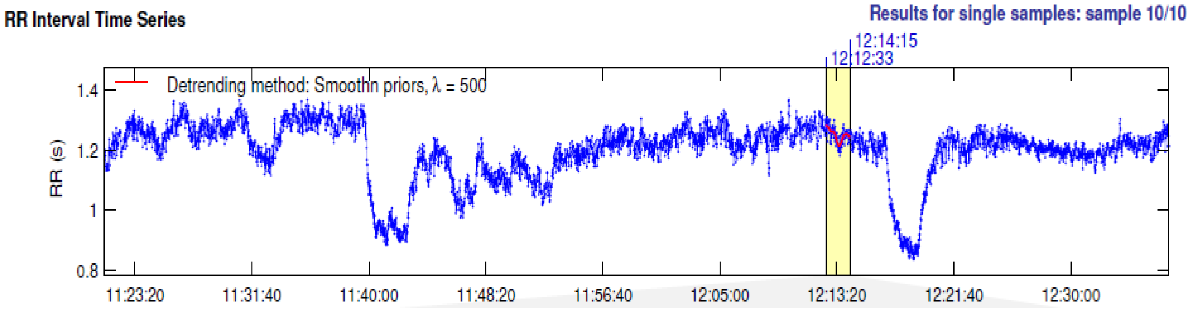



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.1172 | 211 | 34.2 | 34.2 |
| HF (0.15–0.4 Hz) | 0.3398 | 406 | 65.8 | 65.8 |
| Total | | 617 | | |
| LF/HF | | 0.520 | | |

### 5.3.10 Video excerpt 7: Receptive listening to well-known song, ‘Now is the Hour’

Excerpt 7 was extracted from the last time segment before session 17 ended (see the yellow section in Figure 5.19). This excerpt shows an example of how the therapist, after some upbeat music in the first half of a therapy session, gradually brought the session to an end with a number of well-known songs, which had a ¾ time signature. In this excerpt, the therapist was singing ‘Now is the Hour’ with a soft vocal timbre whilst accompanying his singing on the keyboard with broken chords and a reduced texture. His tempo ranged between 37 and 41 bpm. During the excerpt, A appeared to be sitting calmly and staring into space. She displayed a thoughtful facial expression and held her hands together in front of her chest. When the therapist used his bodily expressions to cue the end of the song, she looked at the therapist with a smile and clapped her hands as the song was finished.

Figure 5.19 A's RR time series during video excerpt 7




During excerpt 7, A's mean RR increased to the highest value (1250.3 ms) and her mean HR decreased to the lowest value (48.01 bpm) (Table 5.7), as compared to all the other time segments in session 17. Due to a low mean HR, excerpt 7 was chosen for further qualitative video analysis.

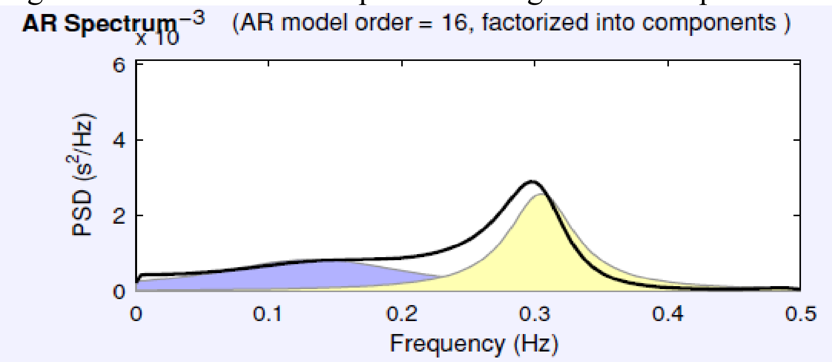
Table 5.7 Indices of A's HR and HRV during video excerpt 7

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1250.3 |
| STD RR (SDNN) | (ms) | 21.0 |
| Mean HR* | (1/min) | 48.01 |
| STD HR | (1/min) | 1.00 |
| RMSSD | (ms) | 33.6 |
| NN50 | (count) | 13 |
| pNN50 | (%) | 16.0 |
| RR triangular index | | 6.308 |
| TINN | (ms) | 90.0 |

Looking at A's relative HF and LF powers (Figure 5.20), parasympathetic nervous activity appeared to be more dominant during the whole excerpt (55.9 %).

Figure 5.20 A’s LF and HF powers during video excerpt 7




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.1328 | 191 | 44.1 | 44.1 |
| HF (0.15–0.4 Hz) | 0.3047 | 241 | 55.9 | 55.9 |
| Total | | 432 | | |
| LF/HF | | 0.790 | | |

### 5.3.11 Session 18 incl. video excerpt 8 and 9

In session 18, A spent 1016 seconds (16.93 minutes) and the therapist spent 1431 seconds (23.85 minutes) on musical expressions (Figure 5.21), which constituted a great proportion of the 30 minute session. 2 seconds of mixed expression were marked for A, as A used the drum stick to hit the snare drum but answered “yes” to the therapist question.

Figure 5.21 A and the therapist’s time (seconds) spent on various expressions during session 18

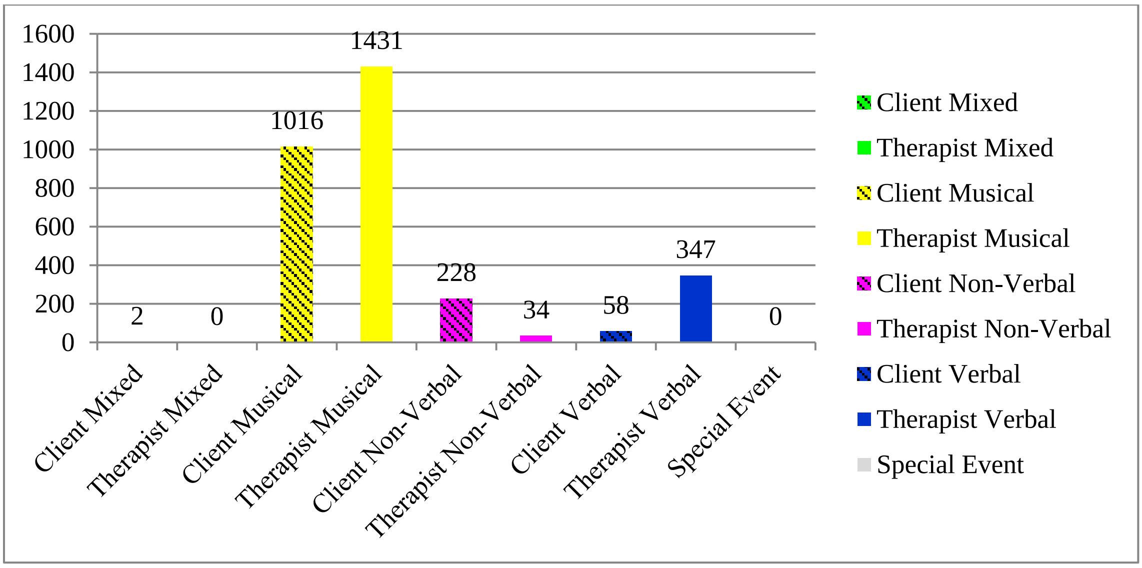
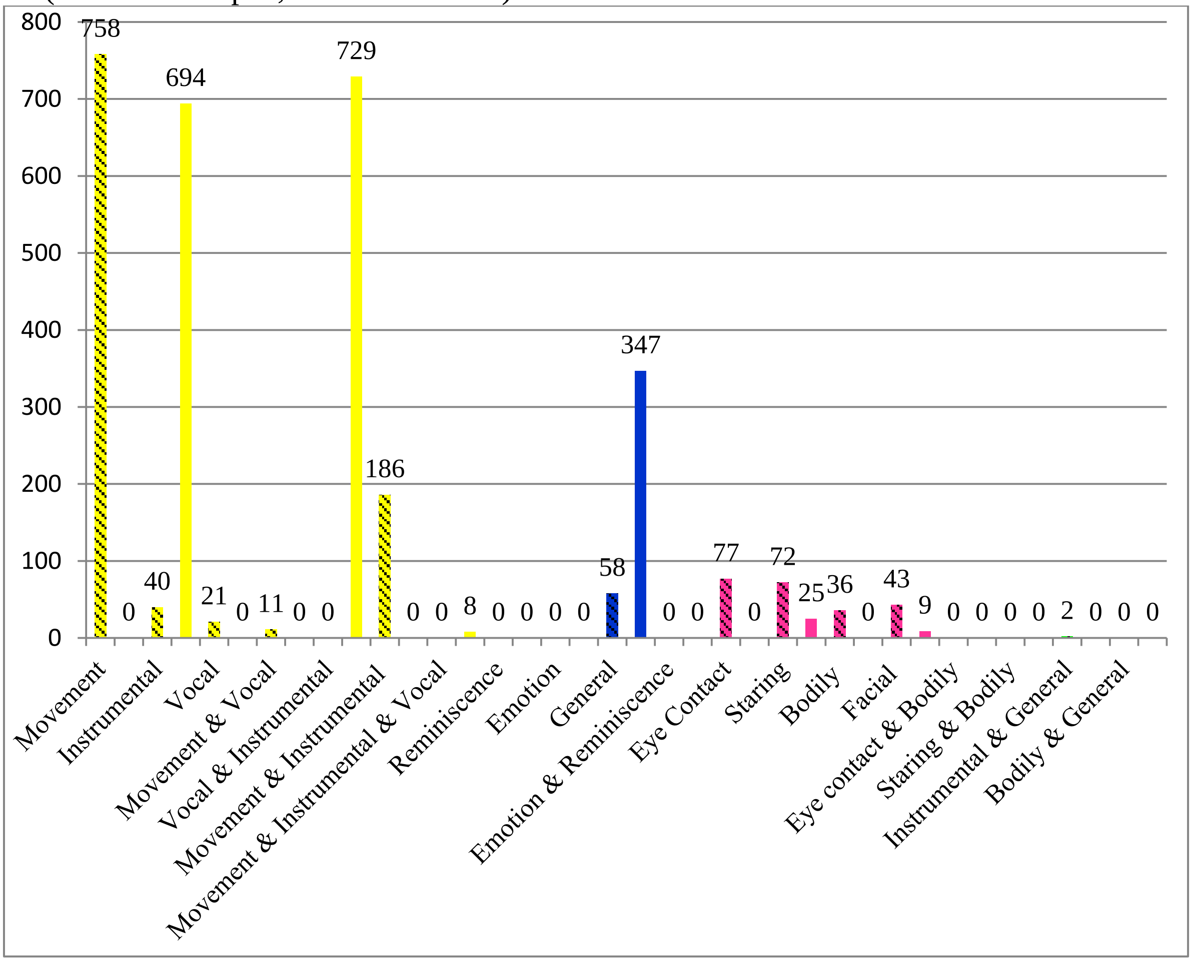


Figure 5.22 below shows that movement (758 seconds) predominantly formed A's musical expressions during session 18. In addition, 186 seconds were spent on coincidental movement and instrumental musical expressions. This was the time when she was playing the snare drum and tapping her feet to the beat. A's musical engagement might be reflected by the therapist's musical expression, which involved keyboard playing (694 seconds) and singing with keyboard accompaniment (729 seconds).

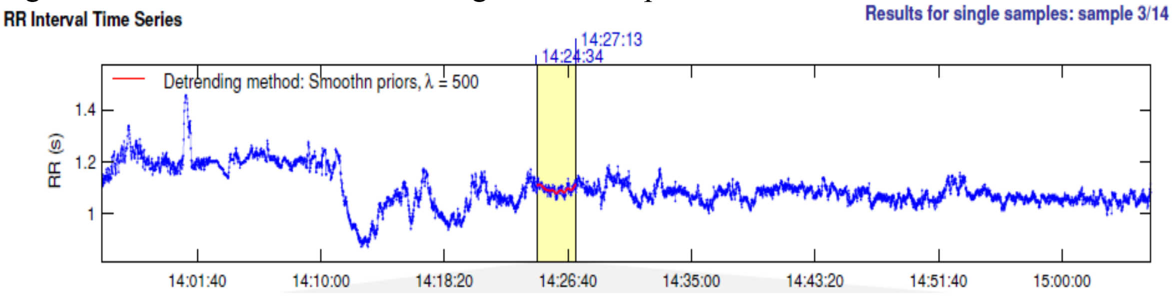
Figure 5.22 A and the therapist's time (seconds) spent on various actions during session 18 (Solid = Therapist, Hashed = Client)




### 5.3.12 Video excerpt 8: Attentional shift

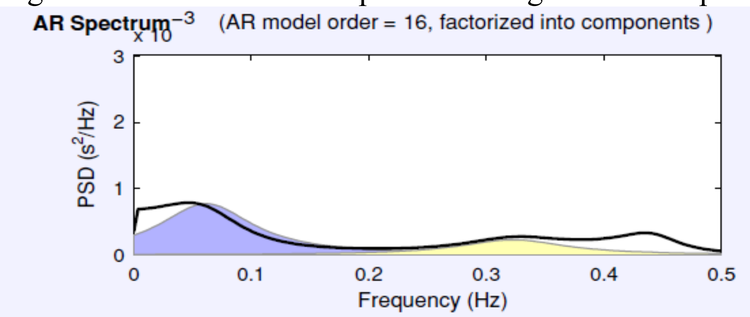
Excerpt 8 started from 8 minutes 11 seconds (14:24:32 in real time) (Figure 5.23) into session 18 when A started exploring the sound of the snare drum and cymbal, and the therapist then joined her by playing the song 'Daisy Bell' on the keyboard. The therapist initially started with an introduction, using a Waltz rhythm. His tempo was 144 bpm (i.e. vivacissimo) at the start but it quickly climbed up to around 163 bpm (i.e. allegrissimo) when he started singing the song. An observation can be made on how A changed the way she played along with the beat in response to the therapist's music. A was initially playing all 3 beats within each waltz rhythm. However, as soon as the therapist started singing the song, A switched to only playing the first beat of each waltz rhythm. This indicated that A's attention could be drawn to a newly introduced auditory stimulus (i.e. the therapist's singing) and to accordingly change her behaviour. From 1 minute 40 seconds into the excerpt whilst continuing to increase the tempo up to around 183 bpm (i.e. prestissimo), the therapist introduced a section of improvisation based on the structure of the song. The therapist sped up this improvisation to around 192 bpm (i.e. prestissimo). As the increased tempo highlighted the accented beat and the therapist's singing was absent during this improvisation, A switched back to playing all 3 beats of the waltz rhythm. However, at 1 minute 54 seconds into the excerpt, the therapist introduced an A minor melody on the keyboard. This seemed to divert A's attention again and she appeared to focus on this melody by returning to only playing the first beat of the waltz rhythm. A gradually stopped playing the cymbal and at the same time briefly produced her usual vocal noises. The therapist then brought the music to an end whilst A was moving the drum stick in the air to the beat and she played a few beats on the drum before the music was finished.

Figure 5.23 A's RR time series during video excerpt 8



Excerpt 8 was selected due to a low relative HF power (23.5%) (see Table 7.4 and Figure 5.24), which indicates that the sympathetic division of the autonomic nervous system was at work as a result of the activation of attentional processes. This could be reflected by changes of musical parameters and elements, such as tempo, key, melody and timbre (sung or instrumental), which were induced by the therapist. The perception of these changes demanded A's shifting attention to variable auditory stimuli. Additionally, this perception indicates that A's ability to detect these subtle changes in music remained accessible.

Figure 5.24 A's LF and HF powers during video excerpt 8




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0625 | 94 | 59.5 | 59.5 |
| HF (0.15–0.4 Hz) | 0.3242 | 37 | 23.5 | 23.5 |
| Total | | 157 | | |
| LF/HF | | 2.527 | | |

### 5.3.13 Video excerpt 9: Calming music and increased parasympathetic activity

Excerpt 9 started from 24 minutes 31 seconds into the session (see table 7.4 and the yellow section in Figure 5.25). As it was a time segment close to the end of session 18, the therapist was shaping a tender feeling by playing and singing 'Golden Slumbers'. This, again, was a tune with a ¾ time signature and the therapist employed broken chords within a reduced musical texture in his keyboard accompaniment. Legato melodic phrasing was applied in both his singing and keyboard playing. His tempo stayed around 97 bpm during the excerpt. During this time, A appeared settled in mood, sitting back with her right elbow on the arm of the chair and using her right hand to support her head. She displayed a pensive facial expression and directed her eye gaze from the side to the space in front of her. She then briefly looked at the therapist as though she was acknowledging the therapist’s music. During this excerpt, A’s mean HR dropped to the lowest point (54.52 bpm) in the whole session 18. This excerpt was selected due to a low SDNN (10.4 ms) (see Table 5.8 and 7.4) compared with time segments in other sessions when A was also receptively listening to music. Although this low SDNN suggested that her RR intervals were less changeable and 10.4 ms was not the lowest value during session 19, her mean RR rose to the highest point (1100.7 ms) in this session during this segment (Table 5.8).

Figure 5.25 A’s RR time series during video excerpt 9

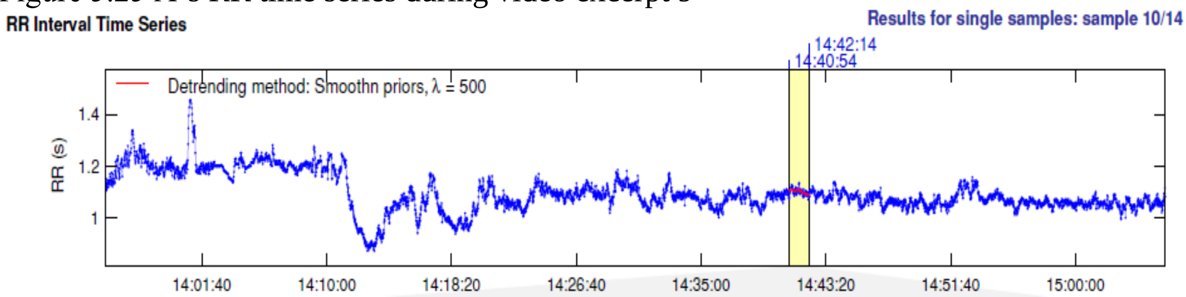


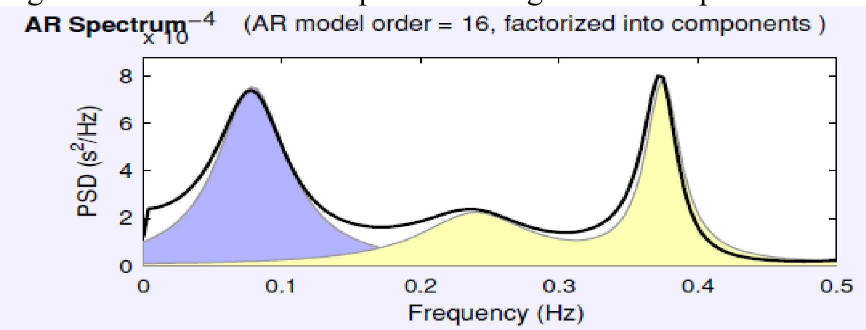

Table 5.8 Indices of A’s HR and HRV during video excerpt 9

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1100.7 |
| STD RR (SDNN) | (ms) | 10.4 |
| Mean HR* | (1/min) | 54.52 |
| STD HR | (1/min) | 0.56 |
| RMSSD | (ms) | 14.4 |
| NN50 | (count) | 0 |
| pNN50 | (%) | 0.0 |
| RR triangular index | | 3.476 |
| TINN | (ms) | 40.0 |

Whilst this large mean RR might be a result of the low mean HR (54.52 bpm), the frequency domain analysis indicated that A’s relative HF power increased to 50.6 % (Figure 5.26) from 27.8% prior to excerpt 9 in session 18 (See Frequency-Domain Results: AR Spectrum on p.113 in Appendix 13). Therefore, the decreased mean HR and the increased mean RR and relative HF power all suggest that A’s parasympathetic nervous activity could be increased in response to the therapist's soothing music by simply listening. It is also worth noting that A's vocal noises were absent through the excerpt.

Figure 5.26 A's LF and HF powers during video excerpt 9




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0781 | 65 | 49.3 | 49.3 |
| HF (0.15–0.4 Hz) | 0.3750 | 67 | 50.6 | 50.6 |
| Total | | 132 | | |
| LF/HF | | 0.975 | | |

## 5.4 Music therapist-carer communication

After each therapy session, the therapist reviewed the videoed session and extracted one or two video excerpts, such as the above examples, to use in the communication with care staff. The protocol for this communication was detailed in section 3.5.3 Intervention in Chapter 3. As the therapist made some observations of A's remaining cognitive functions, he realised that A's auditory and visual perception remained less impaired. In addition, A's attention appeared to be easily distractible by any auditory inputs, particularly the volume, intensity and dynamics of music, which could impact on her resultant behaviours. For example, the therapist's upbeat and rhythmic music could uplift A's mood and activate her motor functions, such as foot tapping and clapping. In contrast, soothing and calming waltz songs, such as 'Falling in Love Again', 'Are You Lonesome Tonight', 'The Ash Grove' and 'Home on the Range', seemed to be more effective in settling A's mood and reducing the volume and frequency of her aberrant vocal noise for a longer period of time, in comparison to upbeat songs. It had also been noticed throughout the 5 months that A seemed to be more able to use words to respond to the therapist. She used more complete and consistent phrases to answer to questions.

Due to the observation of A's remaining perceptual functioning, the therapist was able to inform the care staff that A might be prone to respond to any environmental or social stimuli i.e. background noise, people's voices and expressions. To prevent or minimise A's agitation, A may need to be spoken to with a soft and calm voice, with the support of positive facial and bodily expressions. Awareness should be raised in order to assess and adjust environmental factors, such as sounds from TV or radio and room temperature, for A. the staff were also advised that singing waltz songs with a soft timbre or playing CDs of this type of music could be utilised to de-escalate A's emergent agitation.

# Chapter 6 Results: Case study B

## 6.1 Introduction

This chapter presents the results of the second case study, client B. B was also a participant in the intervention group of the feasibility study. The chapter will be presented in the same format as the previous case study; beginning with a discussion of the client's background information, followed by a description of the 4 selected therapy sessions and 7 video excerpts, and concluding with a description of the post-therapy communication with staff.

## 6.2 Background information

### 6.2.1 General appearance and manner

B is in her early nineties. She is a lady with short hair and is often smartly dressed in trousers and a knitted top. B is able to communicate her needs well but is often seen quietly sitting in the lounge with her fellow residents in the care home. However, offering to make B a cup of tea with some biscuits can successfully engage her in more prolonged conversations, which can prompt her to reminiscence about her past. She has a handbag, that she carries with her everywhere. At times when sitting in the lounge, she can be seen anxiously looking for this handbag, which seems to offer her a sense of security.  B also has a good sense of humour. During the period of the intervention in the current study, B often asked what the watch of the heart rate monitor was for when the research assistant or therapist was attaching it to her wrist. When she was told that it was for checking her heart, she often asked, "Is it still beating?" This was always followed by her saying, "Everyone tells me that I have a good heart."

### 6.2.2 Personal history

B has a bundle of fascinating stories to tell about her school days, family life and career path. She is the third of 7 daughters in a family without boys from Hull, a coastal city in

Northern England. As a child, she appeared to be the brightest in the family and had received good results in school. She was good at all subjects but particularly good at arithmetic. From time to time, B will recall how she was embarrassed by her parents telling the neighbours that she was at the top of the school. Her neighbours used to ask her to help sort out their problems with bills.  In her early working life, B and her husband both served in the British Army and they had been posted in Kenya. During the war, B's husband had been a prisoner of war whom eventually returned after 5 years of capture. After the military life, B became a social worker and dealt with the welfare of children who had troublesome family histories. Recalling her work as a social worker for these children often reminds her of her loving parents and sisters as well as her own children, two sons and two daughters. Her children visit her regularly in the care home.

### 6.2.3 Music preference

B has a good memory of songs, especially the ones recorded by Vera Lynn and Frank Sinatra.  'Anniversary Waltz', 'Love Is A Many Splendored Thing', 'Now is the Hour' and 'Accentuate the Positive' are the songs B often brought to the therapy sessions. B can remember the lyrics of these songs quite well. Singing or listening to these songs often reminds her of the Saturday dances she went to with her sisters in the church hall. She also used to love singing these songs by the window at home and her parents and neighbours, who heard her, would encourage her to sing for them. However, her favourite song is 'Red Sails in the Sunset', which she would talk of in almost every therapy session. This song has significant personal meaning to B, as her sister had requested it to be played on the radio for her. She always becomes animated when talking about how surprised she was when she heard her name announced by the radio host. This is also a song full of nostalgia of her husband, as she used to go to the coast to watch the sails, hoping her husband would swiftly return from his capture.

### 6.2.4 Diagnosis

B has a diagnosis of Alzheimer’s disease.

### 6.2.5 Medication

B is prescribed anti-dementia medication (Donepezil Hydrochloride, 10mg daily) and took this medication throughout the 5 month intervention period of the current study.

### 6.2.6 Neuropsychiatric symptoms

B often displays disorientation to time and the resultant anxiety of being left alone and being separated from her family. This seems to contribute to her delusional ideation: thinking that her husband and parents are still alive and her family will be worried if they cannot find her.

B also experiences episodes of apathy and low mood. During these episodes, she does not want to participate in any activities and at times believes that nothing is able to help her situation. The possible cause of these symptoms seems to be impaired functioning of memory.

### 6.2.7 NPI and DCM outcomes

| | Baseline | Month 3 | Month 5 | Month 7 |
|---|---|---|---|---|
| **NPI**<br>Symptom score<br>(Frequency x<br>Severity) | 9 | 4 | 8 | 8 |
| **DCM**<br>Wellbeing score | 1 | 1.5 | 1.1 | 1.7 |

Table 6.1 B's NPI and DCM outcomes

### 6.2.8 Functioning

B scored 5 on the Global Deterioration Scale (GDS), which means that she has moderately severe cognitive decline and could not survive without some assistance in carrying out activities of daily living. However, she does not require assistance in toileting and eating. As she communicates well and maintains good dexterity and mobility, her major cognitive impairment seems to be exhibited by the functioning of her memory. She is unable to retain new episodic memories and there are some signs of impaired working memory. She cannot remember any addresses or telephone numbers of many years. However, she still knows many facts about herself and others and also remembers the names of her sisters and children. This indicates that she is able to retrieve some information as part of her remote autobiographical memory, including episodic and semantic memories.

### 6.2.9 General process in the therapy sessions

From the previously presented Figure 4.9, it is understood that B generally spent most time during sessions on talking and reminiscence, and music was employed sporadically by the therapist in her therapy sessions. The moments of reminiscence and talking often occurred when B exhibited disorientation and anxiety and thus involved the therapist using verbal intervention to minimise these emergent symptoms. Figure 4.9 also shows that B only engaged musically in singing, followed by receptive listening or vice versa. Over the 5 month music therapy treatment, B chose not to engage in any instrument playing, despite being offered the opportunities to do so.

At the beginning of each therapy session, B often appeared apathetic and low in mood. She would sit in the arms chair with her arm crossed in front of her and her head down to display a closed posture. To engage B, the therapist would verbally invite her to share her favourite songs with him. If B was engaged well with an initial song, either joining in singing with the therapist or receptively listening, she would go on to reminisce about the relevant life events. However, during the reminiscence or talking, B could become disorientated and anxious again. During this time, the therapist would need to use verbal intervention carefully. The therapist's verbal content tended to be based on the known facts about B's personal history and utilised these facts as cues to help B access her residual semantic memory, such as her children's names and the number of her grandchildren. This strategy could often re-orientate B and minimise emergent anxiety. Well-known songs, either preferred by B or familiar to B (e.g., 'Early One Morning' and 'Home Sweet Home') were used when verbal intervention had failed to engage her. These songs were employed during the sessions to either modulate B's mood or enhance her retrieval of long term memory and, therefore, elicit further verbal interaction to reduce apathy. When choosing a song, the therapist had to be cautious about the musical structure and emotive elements of the song in order to achieve specific aims. This was particularly vital at the end of a session; a song would need to either prolong B's calm and relaxed mood or uplift B's spirit in order to prevent the recurrence of symptoms after a therapy session.

The above description has outlined the strategies, that the therapist had implemented in B’s sessions. The following section will now provide further details of the specific events in B’s therapy by illustrating the 7 selected video excerpts (see Table 7.4), which were extracted from the 4 videoed sessions (see Table 3.2).

## 6.3 Description of the 4 therapy sessions and 7 selected video excerpts

### 6.3.1 Session 11 incl. video excerpt 10, 11 and 12

At the beginning of session 11, B initiated singing “Red Sails in the Sunset” after the therapist suggested the song. Although B engaged well with this song, she quickly became disorientated as the song ended and she expressed to the therapist that she ought to go home. In her reality, she thought that she was doing some shopping with her family but they left her in this place (the care home). As B mentioned her family, the therapist took the opportunity to divert B’s attention by thinking about the members of her family and the names of her sisters and children. This strategy was used to direct B’s attention towards accessing her semantic memory of factual information. This then led to her retrieving further autobiographical memory about her father, who loved all his 7 daughters but was particularly proud of B being top of the school. She went on to reminisce about her relationship with her sisters, her jobs after school and how she learned how to make an apple pie from her mother. As the therapist continued to direct B’s attention to the positive aspects of her remote memory, the reminiscing and verbal exchange went on for the rest of the session. During this time, B’s mood appeared to be uplifted and no sign of anxiety or apathy was observed. Before the end of the session, the therapist suggested that they could sing the song ‘Never on a Sunday’. The therapist was hoping that this could further positively enhance B’s mood. Although B was smiling and singing along during the song, she again became worried about her family not being able to find her as soon as the song had been finished. In order to encourage B to remain in the room for collecting her post therapy heart rate data, the therapist, once again, used verbal cues to engage B in retrieving semantic information. The therapist asked B the name of her son and offered to make her a cup of tea, asking her how she would like it. Answering these questions relied on B accessing her semantic self-knowledge, which seemed to effectively divert B's attention and reduce her anxiety. B then decided to stay in the room.

Figure 6.1 shows that both B and the therapist's verbal expression predominated session 11 and amounted to similar time around 24 minutes (B spent 1451 seconds and the therapist spent 1491 seconds). Only 145 seconds (2.42 minutes) and 200 seconds (3.33 minutes) were respectively spent by B and the therapist on musical expression.

Figure 6.1 B and the therapist's time (seconds) spent on various expressions during session 11

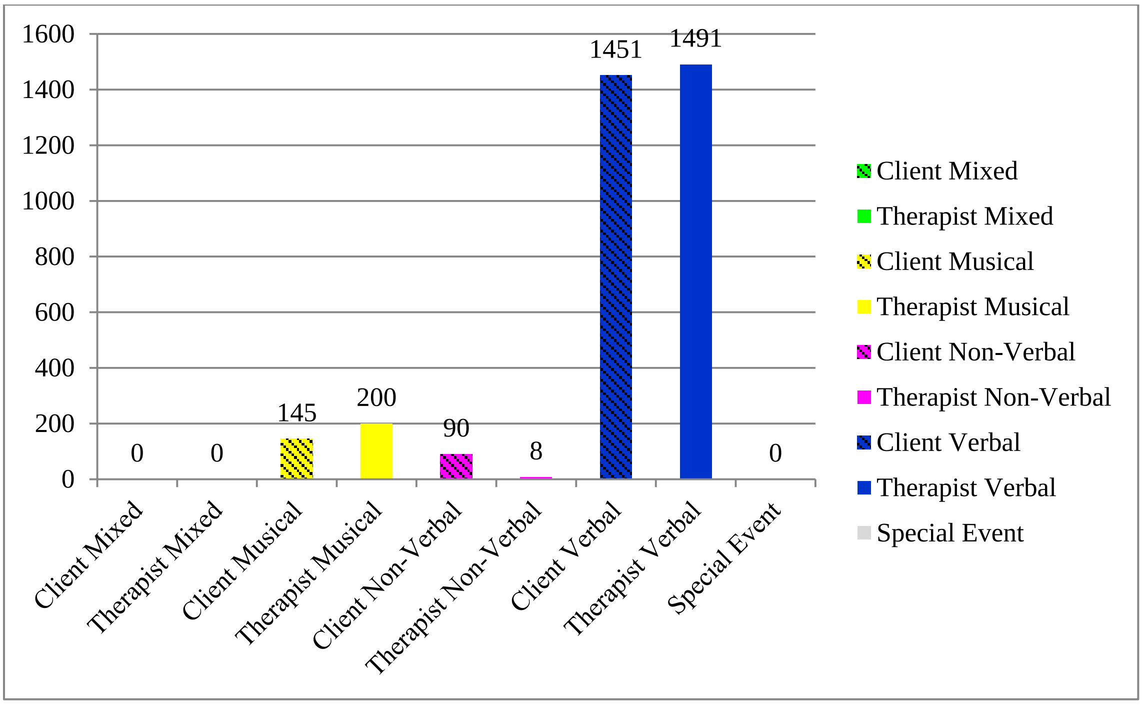
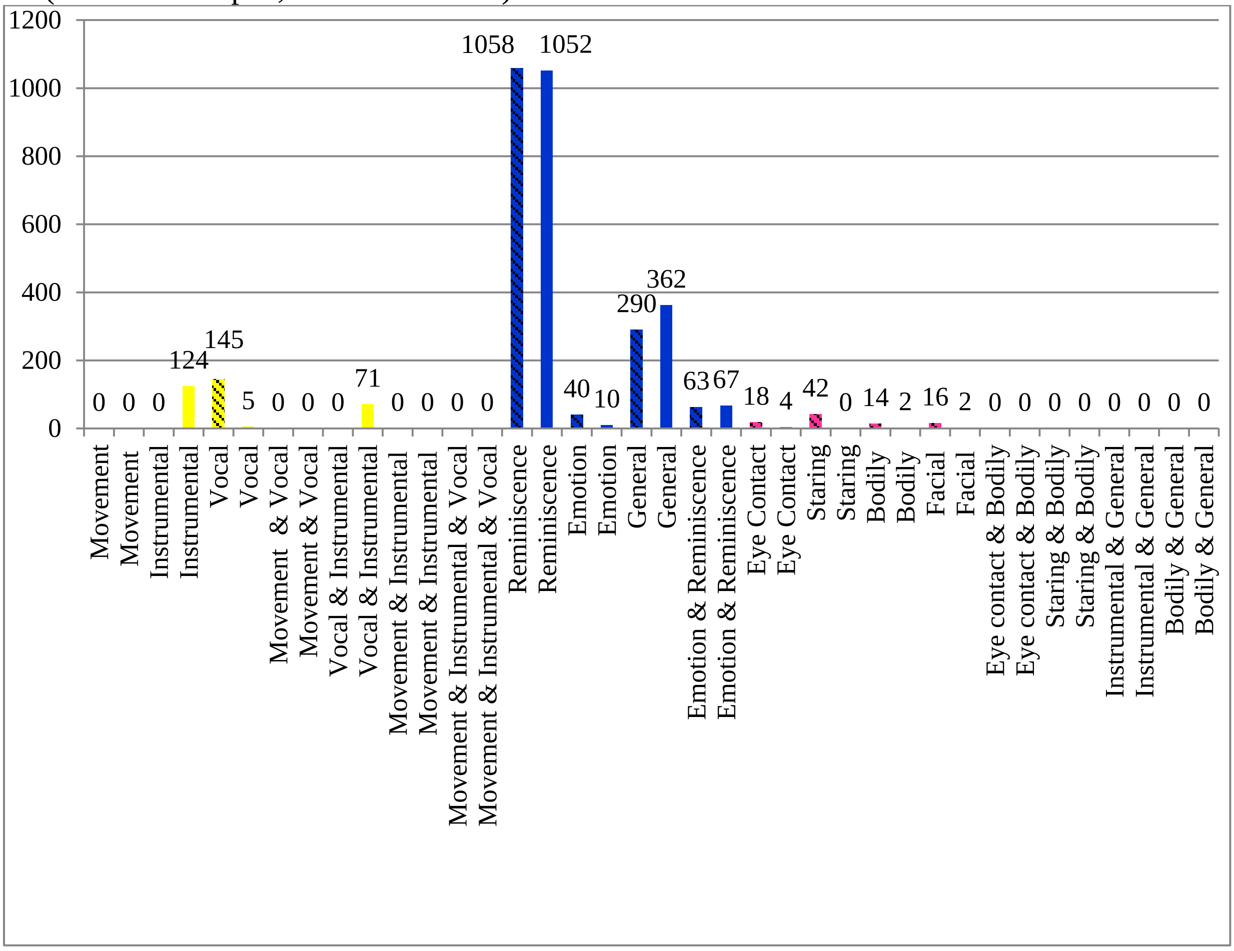


Figure 6.2 B and the therapist's time (seconds) spent on various actions during session 11 (Solid = Therapist, Hashed = Client)




The expressions in Figure 6.1 were broken down into different actions in Figure 6.2. The majority of time within verbal expression was spent on reminiscence by both B (17.63 minutes) and the therapist (17.53 minutes). General discussions also featured within the verbal expression, which included B and the therapist's comments about the song they sang and their conversation about B wanting to go home and the therapist offering B a cup of tea. 40 seconds for B and 10 seconds for the therapist were spent on Emotion, which involved the conversations dealing with B's anxiety of being left alone and her family not being able to find her. B similar amount of time (63 seconds for B and 67 seconds for the therapist) was spent on verbal exchange during which B reminisced about her autobiographical events that involved positive emotions. B and the therapist also used nonverbal expression, such as eye contact, staring, facial and bodily expressions, although these actions were employed sporadically.

### 6.3.2 Video excerpt 10: A song with significant personal meaning

Excerpt 10 was the first time segment identified in session 11 for B and took place at the beginning of the session (between 15:02:50 and 15:04:18 in real time) (Figure 6.3). During the time segment, B initiated singing 'Red Sails in the Sunset' and the therapist accompanied on the keyboard before joining in singing with her. The therapist's accompaniment started with a tempo of 85 bpm. 48 seconds into the excerpt, he changed his accompaniment into a foxtrot style to accent the beat and gradually sped up the tempo to 100 bpm. Although B was smiling at the beginning of the excerpt, she maintained a closed posture, with her arms crossed during her singing throughout. As the song ended, she commented that the song was one of her favourites from long time ago but she still liked to hear it. The red line within the yellow section in Figure 6.3 shows that B's RR intervals generally increased during the excerpt.

Figure 6.3 B's RR time series during video excerpt 10

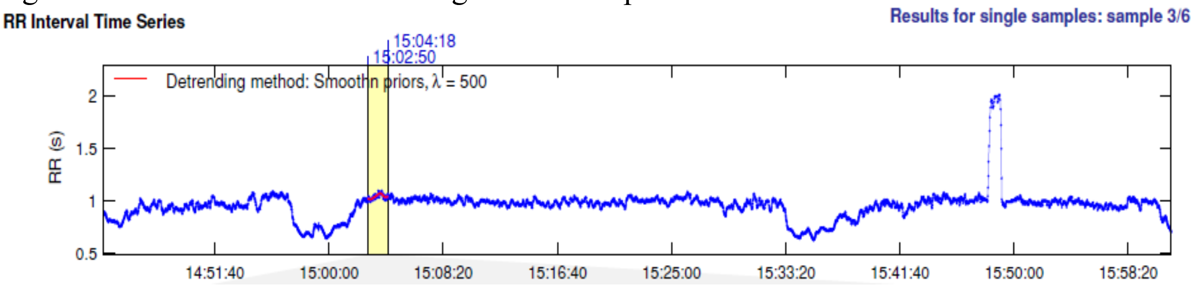



Table 6.2 below shows that B's mean RR increased to 1041.5 ms from baseline 951.9 ms (see Time-Domain Results on p.119 in Appendix 14) whereas her mean HR decreased to 57.64 bpm from baseline 63.10 bpm (see Time-Domain Results on p.119 in Appendix 14) during this excerpt.

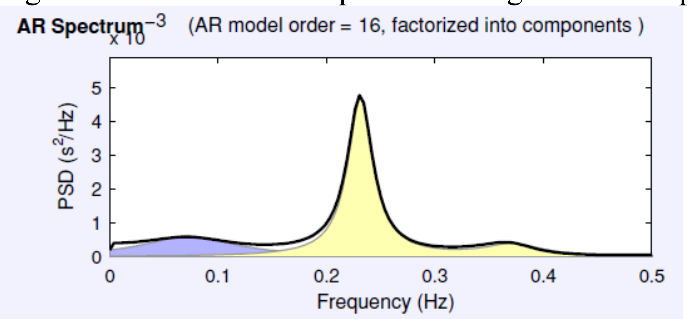
Table 6.2 Indices of B's HR and HRV during video excerpt 10

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 1041.5 |
| STD RR (SDNN) | (ms) | 17.0 |
| Mean HR* | (1/min) | 57.64 |
| STD HR | (1/min) | 1.22 |
| RMSSD | (ms) | 22.9 |
| NN50 | (count) | 2 |
| pNN50 | (%) | 2.4 |
| RR triangular index | | 3.864 |
| TINN | (ms) | 65.0 |

B's relative HF power increased from baseline 17.7% (see Frequency-Domain Results: AR Spectrum on p.119 in Appendix 14) to 75.3 % during the excerpt (Figure 6.4). This high HF power was the reason why the excerpt was selected for the video assessment (Table 7.4). This means that B's heart rate received a sympathetic influence during baseline. However, it shifted to a parasympathetic influence whilst singing this familiar song that had significant personal meaning.

Figure 6.4 B's LF and HF powers during video excerpt 10

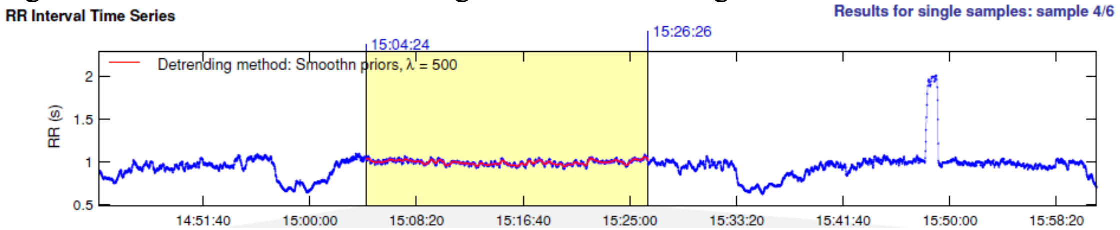



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0742 | 80 | 24.7 | 24.7 |
| HF (0.15–0.4 Hz) | 0.2305 | 244 | 75.3 | 75.3 |
| Total | | 325 | | |
| LF/HF | | 0.328 | | |

### 6.3.3 Video excerpt 11: Using semantic and positive autobiographical memory to induce positive emotions

Excerpt 11 was the first 3 minutes and 28 seconds extracted from the second time segment (Figure 6.5), which was the longest time sequence during session 11 and an example of how B could quickly become anxious and preoccupied with the idea that her family left her. After B commented on the song ‘Red Sails in the Sunset’ at the end of excerpt 10, she turned around to fetch a glass of water and had a sip. However, within this few second time window, B’s anxiety emerged as she lost the song as a stimulus to focus her attention on. With a somewhat upset voice, she verbalised to the therapist that she thought she was going to the shops but then was left alone at this place (the care home). The therapist verbally acknowledged B’s feeling and B went on to say that she had a family and they were all married now. As B’s understanding of her children being married showed that she could access semantic memory, the therapist took the opportunity to help B retrieve further semantic information by asking how old her children were. The therapist was hoping that this would divert B’s attention away from her ideation of being left alone and could lead to her retrieval of positive autobiographical memories, which the therapist was aware of from previous sessions. The therapist went on to ask B how many children she had and the names of her children; B appeared to be able to exercise theses aspects of her semantic knowledge. During the conversation, the therapist also utilised nonverbal expressions, including his facial expressions, eye contact and verbal vocal expressions, such as vocal tone and laughter, to validate and enhance B’s positive emotion. Subsequently, B spontaneously mentioned that her mother had 7 daughters. This provided another opportunity for the therapist to sustain B’s attention in accessing semantic information about her family. This then led to B recalling her father saying that he loved all his children and her mother showing B’s top school results to her neighbours.

Figure 6.5 B’s RR time series during the second time segment of session 11



B's anxiety appeared to subside as time went on in the excerpt. Compared with the previous excerpt, whilst she was singing, B displayed more variable positive facial expressions, such as eye contact and smiles, and head movements, such as turning her head towards the therapist and more frequently shifting her eye gaze. The increased physical movements in this second time segment of session 11 might explain the slightly increased mean HR (60.39 bpm) and shortened mean RR (994.4 ms), compared with the previous time segment whilst singing (see Table 6.2 and below Table 6.3).

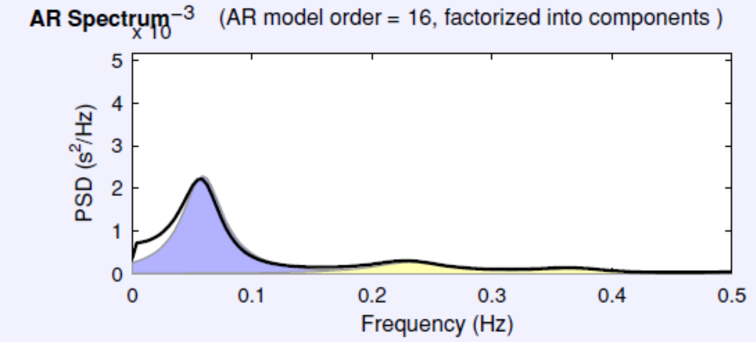
Table 6.3 Indices of B's HR and HRV during the second time segment of session 11

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 994.4 |
| STD RR (SDNN) | (ms) | 13.9 |
| Mean HR* | (1/min) | 60.39 |
| STD HR | (1/min) | 1.28 |
| RMSSD | (ms) | 12.5 |
| NN50 | (count) | 2 |
| pNN50 | (%) | 0.2 |
| RR triangular index | | 4.236 |
| TINN | (ms) | 75.0 |

It is worth noting that when compared with other time segments of B's talking, reminiscing and showing anxiety in other sessions, this second time segment of session 11, showed higher mean RR and lower HR. This was the reason why excerpt 11 was selected for further video assessment (Table 7.4). However, when compared with other time segments in session 11, the second time segment displayed increased heart rate and decreased mean RR as mentioned above. Figure 6.6 shows that B's relative HF power decreased to 23.8% in excerpt 11 from 75.3% (see Figure 6.4) in excerpt 10 when she engaged in singing 'Red Sails in the Sunset'. This suggested that B's sympathetic nervous activity became the dominant influence on B's heart rate in excerpt 11 whilst she was talking and accessing long term declarative (or explicit) memory.

Figure 6.6 B’s LF and HF powers during the second time segment of session 11

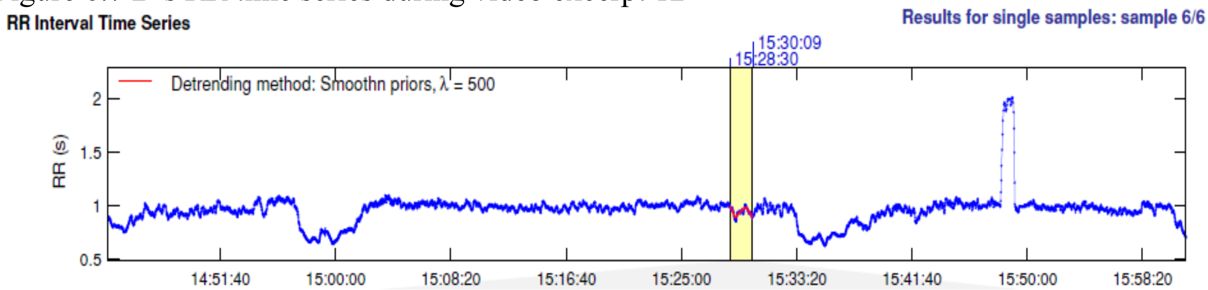



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0586 | 136 | 75.4 | 75.4 |
| HF (0.15–0.4 Hz) | 0.2305 | 43 | 23.8 | 23.8 |
| Total | | 180 | | |
| LF/HF | | 3.166 | | |

### 6.3.4 Video excerpt 12: Using semantic form of self-knowledge to de-escalate emergent anxiety

Video excerpt 12 was extracted from the last time segment of session 11 (see the yellow section in Figure 6.7). It was at the end of the session, after B and therapist finished singing ‘Never on a Sunday’, one of the only two songs sung in this session.

Figure 6.7 B’s RR time series during video excerpt 12




Although B’s spirit appeared to be uplifted during ‘Never on a Sunday’, she immediately reached out to her handbag, saying that she had to get back as soon as the song had ended. B believed that her family would come anytime. At this time, the therapist needed to encourage B to stay in the room in order to continue collecting her post therapy heart rate data. He offered to make B a cup of tea whilst she waited for her family, as this had been used as a method of diversion by the care staff when B became disorientated and worried. To reassure B that her family knew where she was, the therapist mentioned B’s son and asked her what her son’s name was. B’s son visited her earlier during the day before the therapy session. The therapist was hoping that mentioning her son’s visit might generate a sense of familiarity and security, and that asking about her son’s name would engage B in retrieving semantic memory, which B had retained. In order to help B gain a sense of control, he asked B how she would like her tea. B then was able to tell the therapist that she wanted her tea not too strong. This again relied on B’s access to the semantic form of self-knowledge, which had been reported to recruit activation in the medial prefrontal cortex, a region associated with memory, decision making and emotion regulation (Etkin, Egner and Kalisch, 2011; Euston, Gruber and McNaughton, 2012).

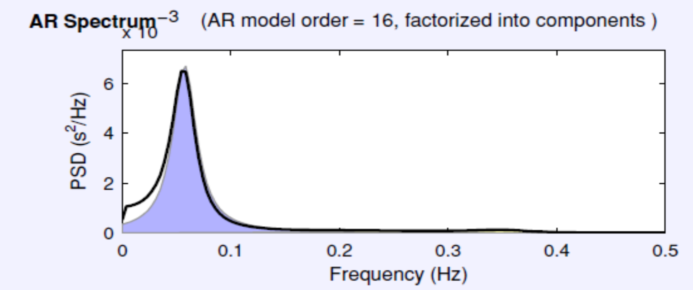
Compared with the previous time segment when singing ‘Never on A Sunday’, B’s heart rate rose to 63.98 bpm (Table 6.4) from 60.15 bpm (see Time-Domain Results on p.123 in Appendix 14) and her mean RR in excerpt 12 dropped to 939.2 ms (Table 6.4) from 998.1 ms (see Time-Domain Results on p.123 in Appendix 14). Furthermore, when the therapist endeavoured to offset the precipitation of B’s anxiety, B’s heart rate appeared to be most changeable during this excerpt, as indicated by the highest value of HR standard deviation (2.35 bpm) among all the time segments in session 11. Excerpt 12 was selected for video assessment due to this high HR standard deviation. During this excerpt, B’s sympathetic nervous activity appeared to be at work as indicated by the high relative LF power (93.1%) (Figure 6.8).

Table 6.4 Indices of B’s HR and HRV during video excerpt 12

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 939.2 |
| STD RR (SDNN) | (ms) | 16.3 |
| Mean HR* | (1/min) | 63.98 |
| STD HR | (1/min) | 2.35 |
| RMSSD | (ms) | 9.2 |
| NN50 | (count) | 0 |
| pNN50 | (%) | 0.0 |
| RR triangular index | | 4.417 |
| TINN | (ms) | 65.0 |

Figure 6.8 B’s LF and HF powers during video excerpt 12




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0586 | 262 | 93.1 | 93.1 |
| HF (0.15–0.4 Hz) | 0.3555 | 19 | 6.9 | 6.9 |
| Total | | 281 | | |
| LF/HF | | 13.547 | | |

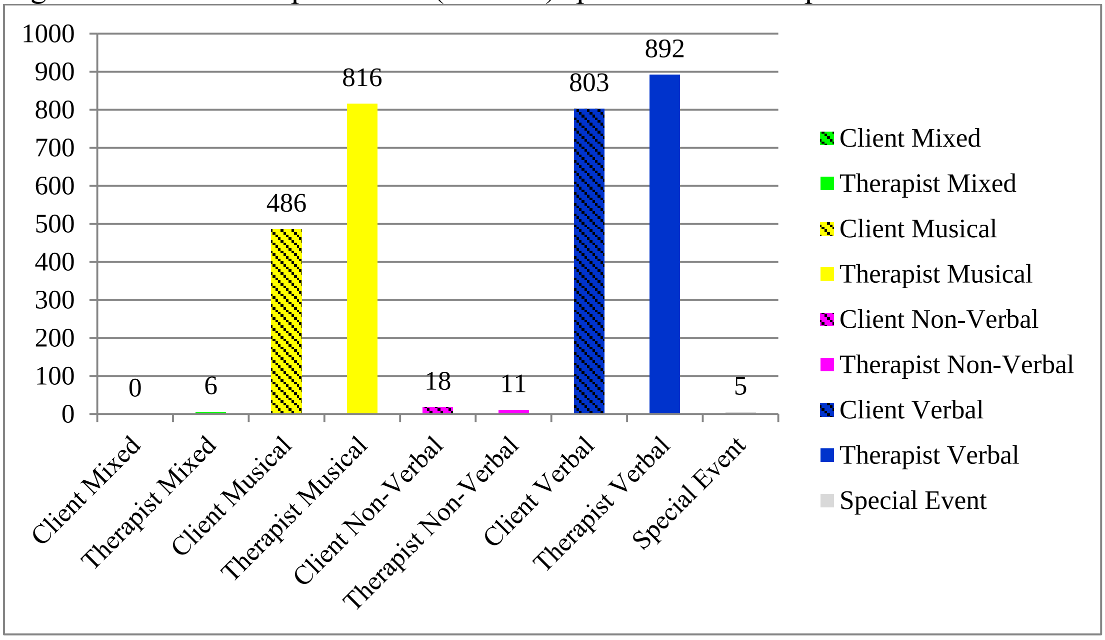
### 6.3.5 Session 17 incl. video excerpt 13 and 14

During the week between session 16 and 17, B had a fall and fractured her right arm. This had seemed to affect her spirit; she came to session 17 with her arm in a cast, looking lethargic and low in mood. The session started with the therapist engaging B in singing ‘Red Sails in the Sunset’ in order to lift B’s mood. This led to a long sequence of conversations throughout the session, involving B reminiscing about the war, her husband and family and how she enjoyed singing in the past. Later on, the therapist engaged B in singing ‘Early One Morning’, ‘Home on the Range’, The Ash Grove’, ‘Falling in Love Again’ and ‘Now is the Hour’. During these songs, B appeared to be listening and singing intermittently. However, signs of apathy could still be observed, as she was singing quietly at times with her eye closed and head bowed down. She was also easily distracted by the discomfort caused by the cast and wrist watch worn for collecting the heart rate data. After singing ‘Now is the Hour’, the last song in the session, B recalled again that many people went to the war and her husband went for a long time but returned to her. This was followed by B asking if the therapist worked every day and reminiscing about her occupation of being a social worker.

The blue bars in Figure 6.9 reflect that both B and the therapist spent almost half of the session on verbal exchange (13.38 minutes for B and 14.87 minutes for the therapist).

The yellow bars show that they also spent a similar amount of time engaging in music. 5 seconds indicating a special event were noted. These were the times when B touched or moved the wrist watch, or when the therapist helped adjust the wrist watch. One second was marked to indicate that a care staff entered the room but quickly left.

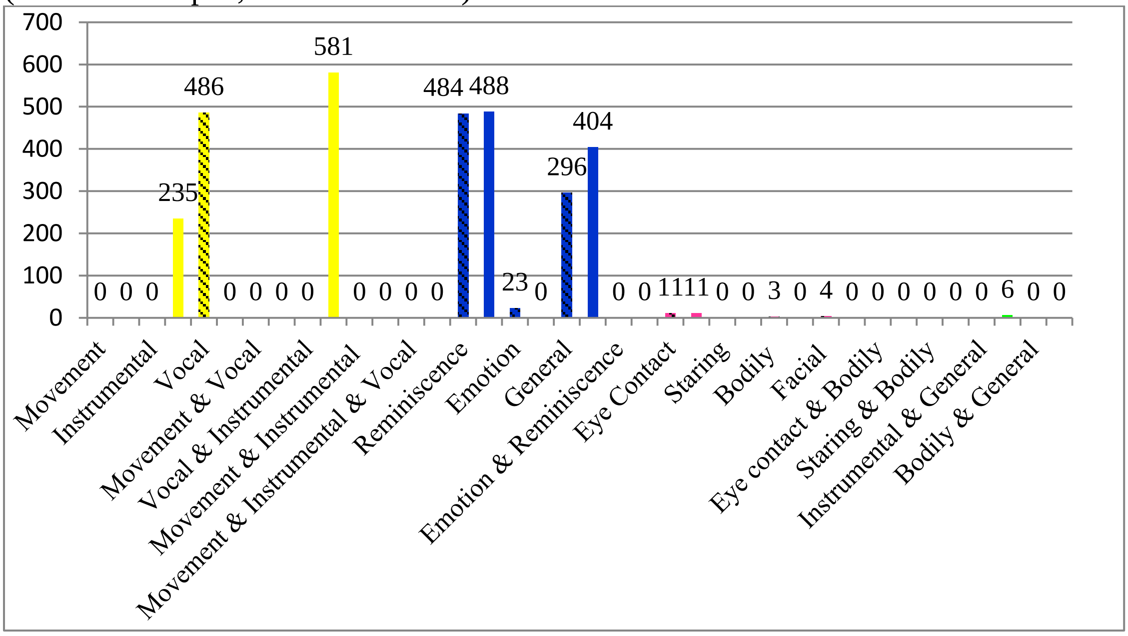
Figure 6.9 B and therapist's time (seconds) spent in various expressions in session 17




When breaking down these expressions into various actions (Figure 6.10), it can be noted that a lot of time during the verbal exchange between B and the therapist was spent on reminiscence and general chatting. However, 23 seconds were marked as Emotion. This was the time when 'Red Sails in the Sunset' generated some recollections and nostalgia; B then said that it was a little bit painful to think about the past years, as a lot of people she used to know were not alive anymore. During this time, sadness could be detected in her vocal tone and facial expressions.

Figure 6.10 also shows that B spent approximately 8 minutes (486 seconds) singing, which was the usual way she engaged musically during her sessions. The 6 minutes marked as Instrumental and General (green colour) for the therapist were shared throughout two occasions. The first occasion was 2 seconds from 21 minutes 54 seconds into the session when B sang more loudly during a verse of 'The Ash Grove' and the therapist encouraged B by saying 'That's nice!' whilst playing the keyboard. The second occasion was 4 seconds from 27 minutes 9 seconds into the session when B appeared drowsy and asked when bed time was; the therapist replied that it was only afternoon and not bed time yet whilst playing 'Falling in Love Again' on the keyboard.

Figure 6.10 B and the therapist's time (seconds) spent on various actions in session 17 (Solid = Therapist, Hashed = Client)

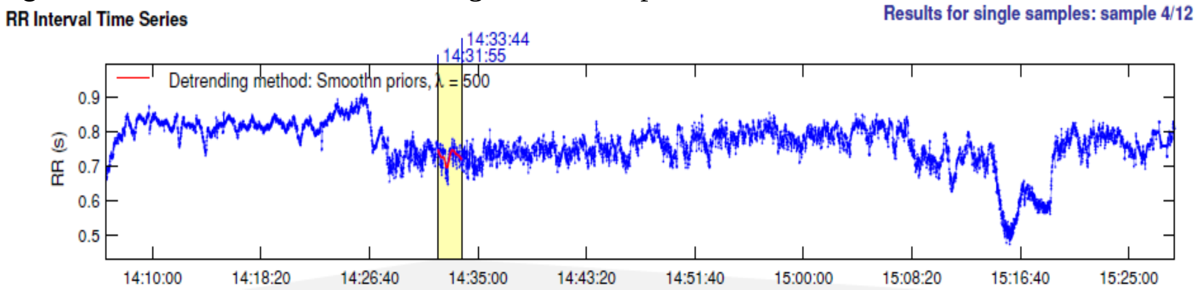



### 6.3.6 Video excerpt 13: Dissipating nostalgia and sadness brought by a meaningful song

Excerpt 13 was the second time segment (the yellow section in Figure 6.11) of session 17, which came immediately after B and the therapist finished singing 'Red Sails in the Sunset' together. During this excerpt, B sat in a closed posture with her head bowed down. She expressed to the therapist that the song had been her favourite for years and recalled that, when she lived in Hull, a lot of men went to sea (referring to the war). The therapist responded to B by suggesting that a lot of the men came back from the war but some did not. He realised that mentioning those who did not return from the war might induce some negative feelings or thoughts in B. Thus, the therapist wanted to quickly divert B's attention towards the positive aspects of these memories. He mentioned B's husband who had returned to her after 5 years of capture; this provided a story with a happy ending. B responded to the therapist's verbal expressions with eye contact and her own verbalisations. However, as soon as she had finished speaking, her head quickly stooped down again, showing signs of apathy.

In order to lift B's mood, the therapist asked if her husband had liked her singing, hoping this question would lead to an opportunity to sing another song. B answered that her husband did and volunteered the information about her neighbours, who also liked her singing. The therapist then responded to B with positive vocal expressions, such as laughter and surprise. He went on to compliment B's nice singing voice and asked her what songs she used to sing. Subsequently, B displayed a subtle smile and briefly lifted up her head.

Figure 6.11 B's RR time series during video excerpt 13




Excerpt 13 was selected for the video analysis due to a high mean HR (82.48 bpm) and a low mean RR (728.4 ms) (see Figure 6.5 below and Table 7.4), as compared to other time segments from sessions in which B was also reminiscing. However, it is worth noting that in session 17 these were not the highest mean HR and lowest mean RR recordings.

The mean HR (82.48 bpm) in excerpt 13 had increased from 81.26 bpm in the previous time segment (see Time-Domain Results on p.125 in Appendix 15), whilst B was singing. As the mean heart rate increased, the mean RR (728.4 ms) decreased from 739.1 ms during B's singing in the previous time segment (see Time-Domain Results on p.125 in Appendix 15). This indicates that not only did singing a personal song increase B's heart rate, but engaging in conversation with the therapist, specifically recalling and discussing past events, further increased B's mean HR and reduced her mean RR.

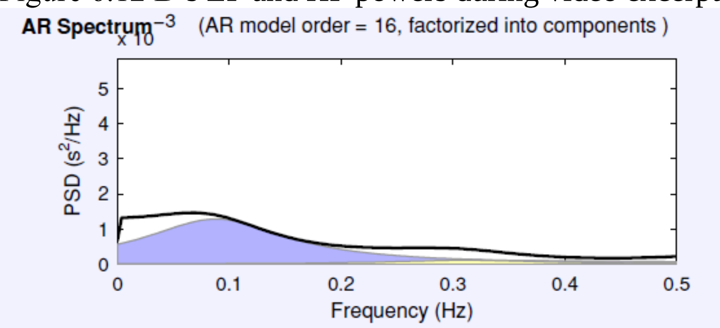
Table 6.5 Indices of B's HR and HRV during video excerpt 13

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 728.4 |
| STD RR (SDNN) | (ms) | 19.6 |
| Mean HR* | (1/min) | 82.48 |
| STD HR | (1/min) | 2.81 |
| RMSSD | (ms) | 20.7 |
| NN50 | (count) | 4 |
| pNN50 | (%) | 2.7 |
| RR triangular index | | 5.593 |
| TINN | (ms) | 75.0 |

B's relative HF power in excerpt 13 was reduced to 6.6 % (Figure 6.12) from 17.5% during the previous time segment whilst singing (see Frequency-Domain Results: AR Spectrum on p.125 in Appendix 15). This suggests that influence from the sympathetic division of the autonomic nervous system was further increased on B's heart rate during her engagement in reminiscence.

Figure 6.12 B's LF and HF powers during video excerpt 13

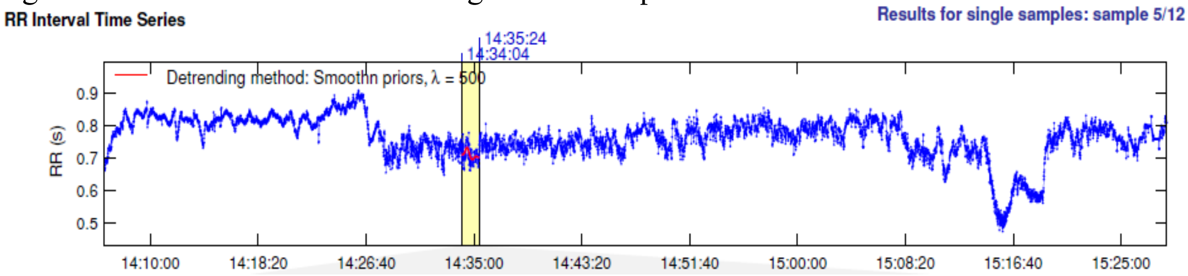



| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 105 | 26.6 | |
| LF (0.04–0.15 Hz) | 0.0898 | 243 | 61.7 | 84.0 |
| HF (0.15–0.4 Hz) | 0.3125 | 26 | 6.6 | 9.0 |
| Total | | 394 | | |
| LF/HF | | 9.338 | | |

### 6.3.7 Video excerpt 14: Familiar songs to uplift spirit

Excerpt 14 (the yellow section in Figure 6.13) carried on from the conversation during excerpt 13 in session 17, when the therapist asked B what songs she used to sing. At this time, B kept her head down, showing signs of lethargy. The therapist then suggested they sing the song “Early One Morning”. He chose this song as it has a 4/4 time signature and a series of major-third intervals, which shape the gentle rise and falls of the melodic contour. These structural features of the song allowed the therapist to accent the beat and he utilised the ascending and descending melody to induce the climax of emotional experience.

Figure 6.13 B’s RR time series during video excerpt 14




After the therapist played an introduction on the keyboard, B gradually joined in with the therapist’s singing. Her singing was louder and more consistent throughout this song. At one point, B slightly lifted her head and briefly opened her eyes, but otherwise her eyes remained closed throughout. Towards the end of the song, she lifted head to lean against the back of the armchair. As the song ended, the therapist asked her if she knew any other verses to the song. With her eyes open and a smile on her face, B replied that she used to know them all. Subsequently, the therapist complimented B on how good she was at memorising the words. This seemed to sustain B’s spirit and engagement in their interaction.

Whilst playing the keyboard, the therapist started his tempo at 67 bpm but gradually increased it to 78 bpm at the point when he repeated the song. Whilst singing, B’s mean

HR increased to 84.56 bpm and mean RR further decreased to 710.5 ms (Table 6.6). The increased standard deviation of B's HR (2.88 bpm) and RR (21.9 ms) during singing indicates that B's heart rate and RR interval became more changeable during the singing in excerpt 14 than during the recalling of life events in excerpt 13.

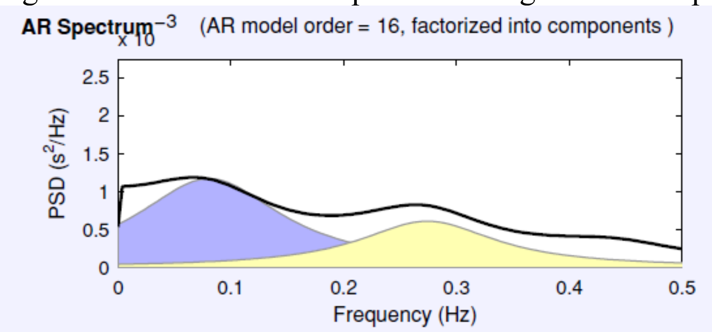
Table 6.6 Indices of B's HR and HRV during video excerpt 14

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 710.5 |
| STD RR (SDNN) | (ms) | 21.9 |
| Mean HR* | (1/min) | 84.56 |
| STD HR | (1/min) | 2.88 |
| RMSSD | (ms) | 26.1 |
| NN50 | (count) | 9 |
| pNN50 | (%) | 8.0 |
| RR triangular index | | 5.947 |
| TINN | (ms) | 100.0 |

Moreover, Figure 6.14 below indicates an increase in B's relative HF power (30.2 %) during singing in excerpt 14, compared with 6.6% (Figure 6.12) during reminiscence in excerpt 13. Although this indicates an increase in parasympathetic nervous activity during singing, sympathetic nervous activity was still the dominant influence on B's heart rate.

Figure 6.14 B's LF and HF powers during video excerpt 14




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0820 | 218 | 51.1 | 51.1 |
| HF (0.15–0.4 Hz) | 0.2734 | 129 | 30.2 | 30.2 |
| Total | | 426 | | |
| LF/HF | | 1.691 | | |

### 6.3.8 Session 18 incl. video excerpt 15

B appeared to be in a brighter spirit in session 18, which started with B recalling her being a bright pupil in her school days. She also recalled that her parents were very proud of her. However, she seemed to possess the ideation that her father was proud of her when she was at home, and was still proud of her now. As B exhibited this sign of disorientation, the therapist diverted her attention to thinking about her favourite song, ‘Red Sails in the Sunset’, and asked B why she liked this song. B recalled the time when she first fell in love with her husband, and how the song played one evening whilst she sat with him. This subsequently led to the therapist and B singing the song together. To continue enhancing B’s spirit, the therapist engaged B in singing more songs, such as ‘Lilly Marlene’ and ‘Que Sera Sera’. B also spontaneously sang the songs ‘Love is A Many Splendored Thing’ and ‘Anniversary Waltz’. However, in between these songs, B displayed impaired episodic memory, as she would repeatedly speak about her favourite song being ‘Red Sails in the Sunset’. Interestingly, when she repeated this, she seemed to be able to retrieve different sets of associated information, such as her sister requesting this song on the radio for her and hearing her name mentioned on the radio. Later on in the session, B recalled the Saturday dances she went to and how she met her husband. Despite her repetitive verbalisations, B seemed fairly settled in mood and displayed frequent smiles and eye contact.

Towards the end of the session, B expressed to the therapist that she would like to go back home, asking if the therapist knew where she lived. This suggested that B might, in a sense, have an understanding of her current situation, but also indicated the precipitation of B’s anxiety. The therapist thus tried to engage B in thinking about her children, particularly her son, who had visited her in the morning. However, B seemed to be preoccupied with the ideation that her family would be worried if they could not find her.

Figure 6.15 below indicates that verbal exchange was still the predominant element in B's therapy during session 18, amounting to 20.92 minutes (1255 seconds) for B and 21.99 minutes (1319 seconds) for the therapist. B and the therapist both spent less than 10 minutes on the secondary element of musical expressions. Nonverbal expressions also featured briefly in the session. There were also 4 seconds marked as therapist's mixed expression, which happened on two occasions (3 seconds from 16 minutes 41 seconds and 1 second at 21 minutes 59 seconds into the session) where the therapist spoke to B whilst still playing the keyboard.

Figure 6.15 B and the therapist's time (seconds) spent on various expressions during session 18

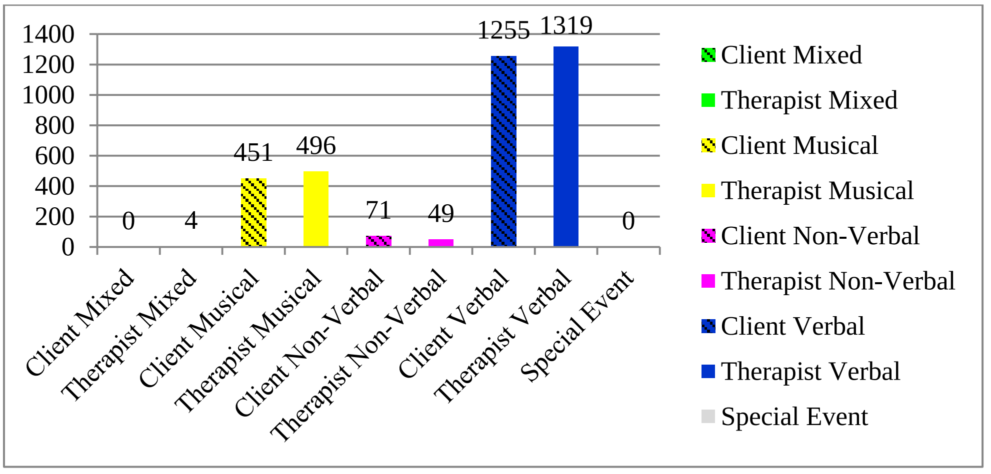
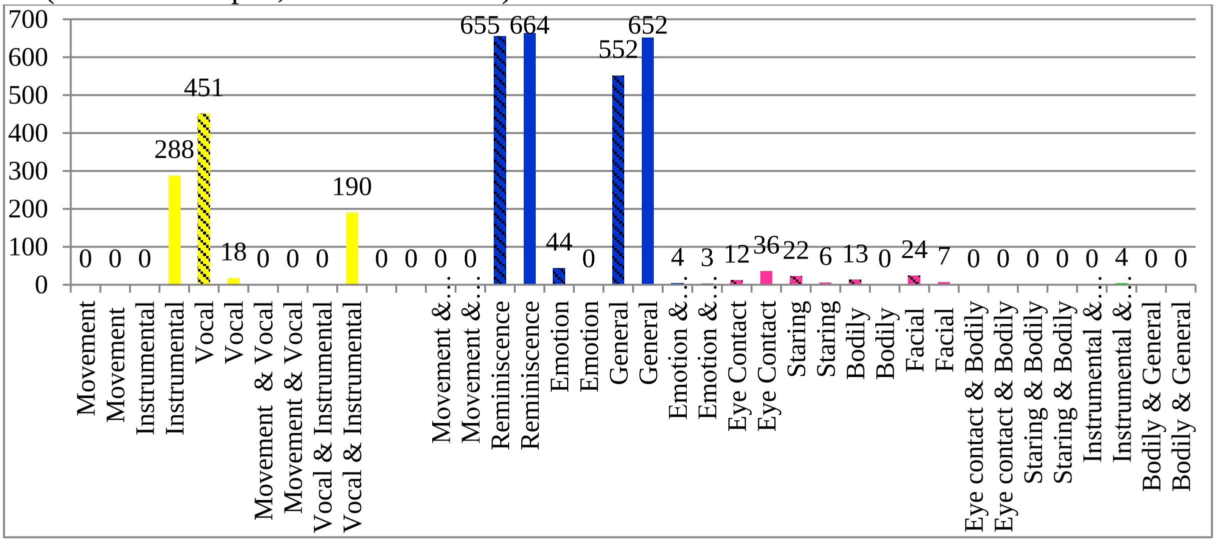



Figure 6.16 breaks down the expressions outlined in Figure 6.15 and shows that all 451 seconds of B's musical expression was spent on singing. It also shows that B sang more than the therapist in session 18. Within verbal expression, both B and the therapist spent most of the time on conversations involving reminiscence, followed by general chats. There were 44 seconds marked as verbal expression showing emotion for B. These 44 seconds were occurred over three moments towards the end of the session, when B started to show signs of anxiety. On two occasions, she asked the therapist if she would have any trouble leaving this place and expressed that she needed to go home soon, otherwise her family would be calling the police. There were also 4 seconds for B and 3 seconds for the therapist marked as Emotion & Reminiscence. These occurred at 23

minutes and 28 seconds into the session, when B smiled and commented, “Happy days” after they finished singing ‘Red Sails in the Sunset’. The therapist then echoed B’s verbal expression to validate her feelings.

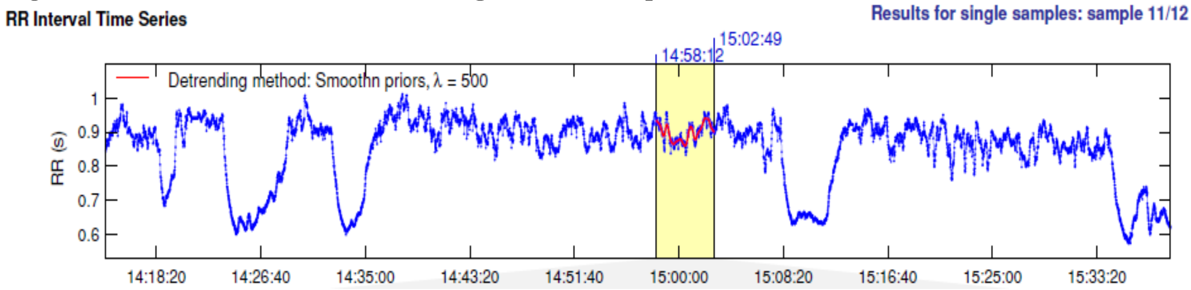
Figure 6.16 B and the therapist’s time (seconds) spent on various actions during session 18 (Solid = Therapist, Hashed = Client)




### 6.3.9 Video excerpt 15: A meaningful song to promote reminiscence

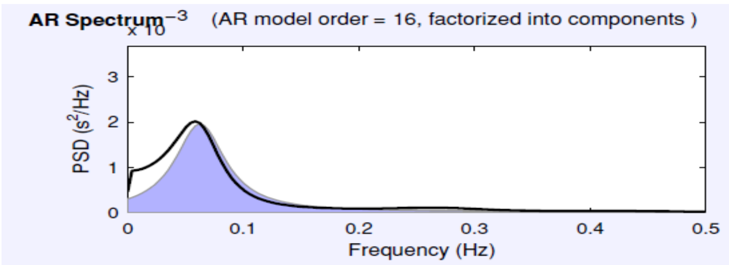
Excerpt 15 shows an example of how singing a personal song could lead to B’s reminiscence of past life events. After singing her favourite song ‘Red Sails in the Sunset’ with the therapist, B recalled that the song was played on the radio for her. She then continued to reminisce about how everyone dressed up for the Saturday night dances in the church hall, and the entry fee was only 6 pence. However, B displayed clear impairments in the functioning of her short term memory and had been repetitive with her verbal content in this session. Prior to excerpt 15, she had already recalled the song and how many men from Hull went out to sea. During excerpt 15, she spoke about this song and the associated memories for the sixth time. However, in this excerpt, she seemed to recall more information about the Saturday dances. The red line within the yellow section in Figure 6.17 below shows a trend of B’s RR interval, which decreased from the outset of the excerpt but gradually increased towards the end. This suggested that her RR interval dropped during her singing but climbed again during her reminiscence. Whilst singing, the therapist started the tempo with 82 bpm but gradually increased it to 88 bpm. B's mean HR (66.87 bpm) and mean RR (898.2 ms) in excerpt 15 (Figure 6.17) were similar to those in the prior time segment, when she was solely reminiscing (mean HR 66.98 bpm; mean RR 897 ms) (see Time-Frequency Domain Results on p.146 in Appendix 16).

Figure 6.17 B's RR time series during video excerpt 15




Excerpt 15 was selected for the video assessment due to a very low relative HF power (0 % detected by the Autoregressive Spectral analysis) (Figure 6.18). Whilst solely reminiscing during the time segment prior to excerpt 15, B's relative HF power was also low (5.9 %) (see Frequency-Domain Results: AR Spectrum on p.146 in Appendix 16).

Figure 6.18 B's LF and HF powers during video excerpt 15




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 37 | 20.6 | |
| LF (0.04–0.15 Hz) | 0.0625 | 143 | 79.4 | 100.0 |
| HF (0.15–0.4 Hz) | 0.0000 | 0 | 0.0 | 0.0 |
| Total | | 180 | | |
| LF/HF | | Inf | | |

### 6.3.10 Session 19 incl. video excerpt 16

Session 19 was the last session B attended during the 5 month intervention period for the randomised controlled feasibility study. B's arm was healing well at this point and in the session she could be seen in a good spirit without a sling to support her arm. At the beginning of the session, B was sipping a cup of tea and eating a biscuit, which were used as an incentive to encourage B to come to the quiet lounge for her therapy. Music appeared in the session very quickly, as the therapist mentioned B's favourite song and engaged her in listening and singing the song. When the song ended, he engaged B in reminiscence by using some verbal cues based on B's personal history. He cued B that he knew the song was B and her husband's favourite and that B told him about her Saturday dances. As B reminisced, the therapist encouraged her to think about the songs she used to sing or dance to. This then led to B's singing 'Anniversary Waltz', along with the therapist's keyboard accompaniment. Although B's singing voice sounded brighter and more consistent, her head drooped slightly and she gradually closed her eyes whilst singing. Towards the end of the song, the therapist thought that the song may have triggered certain memories that had upset B, as she used her left hand to cover her face. However, she lowered her hand and smiled at the therapist when he finished the song. The song enabled B to recall how she met her husband at the dance. Later on in the session, the therapist engaged B in singing and listening to other songs, such as 'Home Sweet Home', 'The Water is Wide', 'Home on the Range' and 'Ash Grove'. The therapist was utilising these lyrical songs in order to generate a tender feeling and relaxation. However, he had to be cautious with his choice of songs, as B could quite easily become lethargic again. Therefore, the therapist sang and played 'Red Sails in the Sunset' a second time, followed by a more upbeat song, 'Accentuate the Positive'. The therapist chose these songs at the end of the session with the motive of enhancing B's emotional arousal to ensure that B would finish the session with a good spirit. Just before the session ended, B recalled that a lot of people went away to the war and never knew if they were coming back. From B’s verbal and bodily expressions, the therapist could detect some signs of nostalgia and sadness and therefore directed B’s attention towards thinking of positive aspects, such as her husband, who returned to her from the war.

Figure 6.19 below shows that session 19 stood out from B’s other sessions, as she engaged slightly more musically (682 seconds) than verbally (580 seconds). 4 seconds were marked as a special event. This was 8 minutes and 36 seconds into the session, when a new staff member entered the room to access documents. As she was a new carer who was not familiar with music therapy, she greeted B and stayed in the room for 1 minute and 12 seconds before she spoke to the therapist on her way out of the room.

Figure 6.19 B and the therapist’s time (seconds) spent on various expressions during session 19

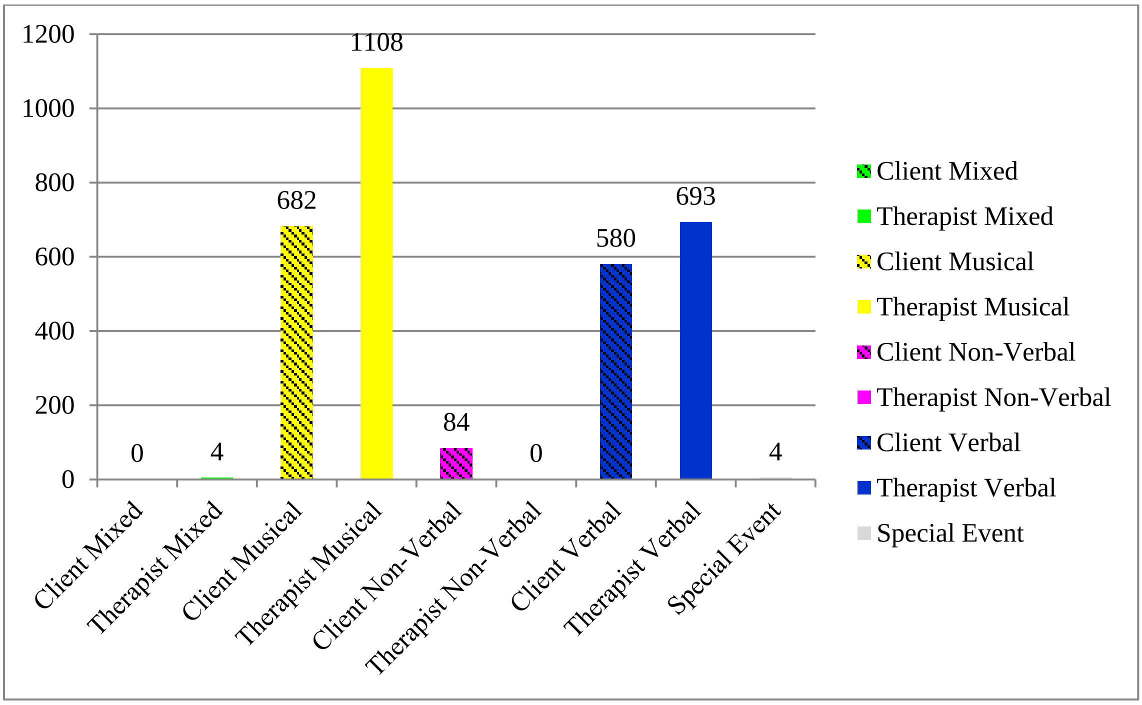
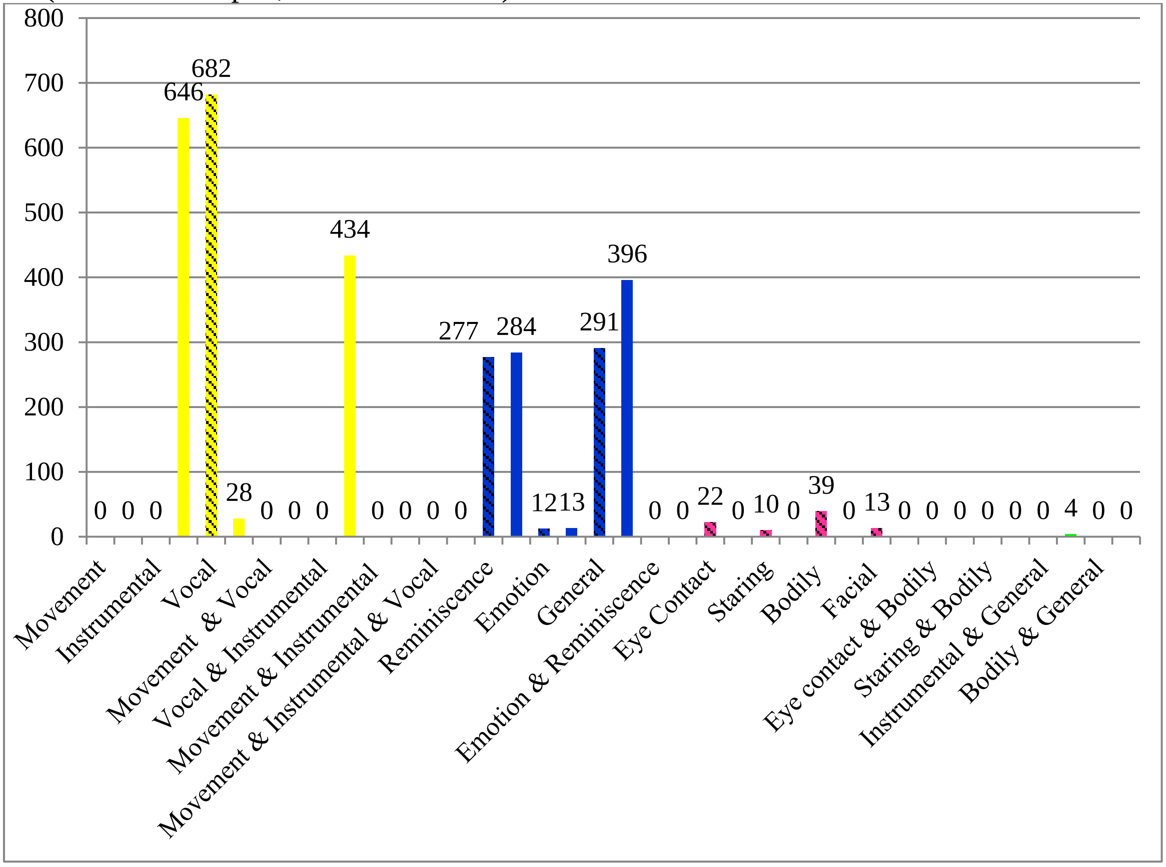



Figure 6.20 below presents the breakdown of the expressions outlined in Figure 6.19. B’s 682 seconds of musical expression comprised solely of singing. Similar to previous sessions, the therapist’s musical expression in session 19 involved singing with

keyboard accompaniment, keyboard playing and singing a cappella. Both B and the therapist also spent a lot of time during session 19 on verbal exchange involving reminiscence (277 seconds for B and 284 seconds for the therapist) and general chats (291 seconds for B and 396 seconds for the therapist). There were also 12 seconds and 13 seconds respectively marked for B and the therapist's verbal expression involving emotional content. These seconds made up two occasions of emotional verbal content. The first occasion was 9 minutes and 32 seconds into the session after B and the therapist finished singing 'Anniversary Waltz'. The song brought back B's memory of how she met her husband during a Saturday dance. She told the therapist, with some delight clearly expressed in her vocal and facial expressions, that she and her husband had been married for a long time. The second occasion was 21 minutes 22 seconds into the session after 'Home on the Range' was finished. The therapist and B were talking about how singing could generate a good feeling; B was smiling and showing a good spirit. Figure 6.20 also indicates that B's nonverbal expression involved eye contact, staring, facial and bodily expressions throughout session 19.

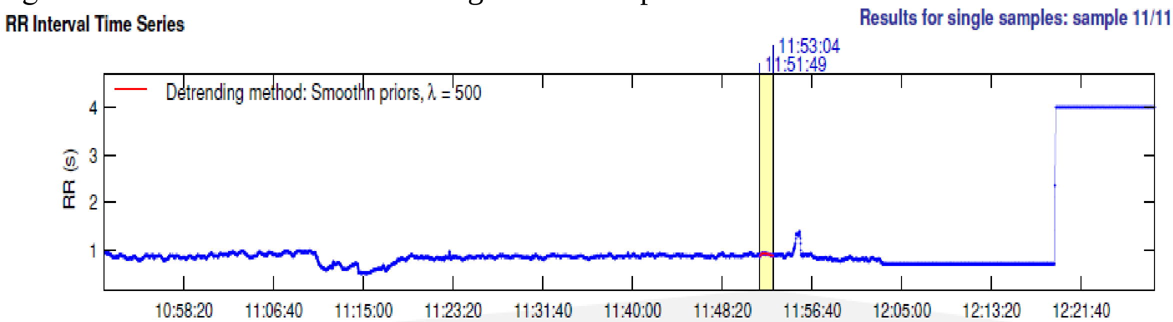
Figure 6.20 B and the therapist's time (seconds) spent on various actions during session 19 (Solid = Therapist, Hashed = Client)




### 6.3.11 Video excerpt 16: Directing attention to positive aspects of remote memory to prevent emergent symptoms

Excerpt 16 was the last time segment (Figure 6.21 and Table 7.4) identified in session 19. Following on from the previous time segment, when the therapist engaged B in singing and listening to the last song of the session ('Accentuate the Positive'), excerpt 16 shows the moment when B initiated a conversation. When the song came to an end, she stated that the song made her think too much. Despite singing and displaying positive expressions, such as smiles, at the end of the song, B quickly switched to recalling the time when people went to war and never knew if they were coming back. At this time, she exhibited a closed posture wither her head down and eyes closed. The therapist had experienced similar situations in previous sessions, when B could very quickly become apathetic and anxious again after her engagement in singing. To prevent the precipitation of B's emergent apathy and low mood, the therapist used his verbal cues to engage B in thinking about the positive aspects of her time during the war. He mentioned B's husband, who returned to her after having been a prisoner of war. The therapist chose his words carefully in order to incorporate positives phrases into his verbal expressions; for example, using "happy ending" to refer to B's husband's return. It was clear, though, that B could switch into thinking the negative aspects, and stated that some people did not have a happy ending. In this moment, the therapist tried to reinforce the positive fact that B did have her husband back and that B was "lucky" to have this happy ending. He continued to say to B that her story was the best story he had heard. During this conversation, B would open her eyes from time to time and verbalise "yes" to acknowledge the therapist's verbal expressions. B also showed the motivation to sit up and lean towards the therapist in order to ask him to repeat what he said when she could not quite catch what he was saying.

Figure 6.21 B's RR time series during video excerpt 16




The yellow section in Figure 6.21 showed that B's RR interval remained less changeable during excerpt 16. This excerpt was selected for the video assessment due to the low standard deviation of heart rate and RR interval (Table 7.4) compared with other time segments of similar activity during previous sessions. However, Table 6.7 below also indicates that B's mean RR in excerpt 16 increased to 915.5 ms from 889.0 ms in the previous time segment (see Time-Domain Results on p.158 in Appendix 16), when B was engaged in listening to and singing 'Accentuate the Positive'. Her mean HR also dropped slightly to 65.57 bpm from 67.51 bpm when she was engaged musically in ‘Accentuate the Positive’ (see Time-Domain Results on p.158 in Appendix 16).

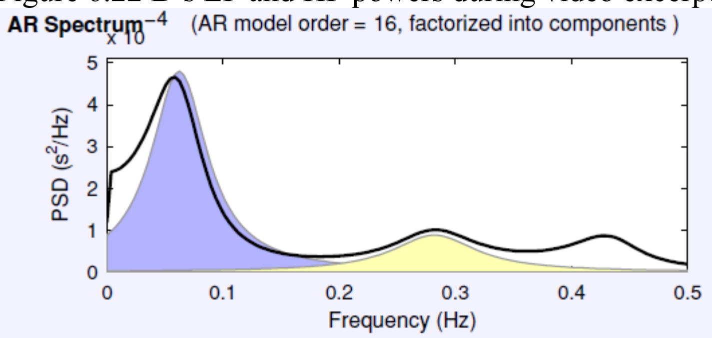
Table 6.7 Indices of B’s HR and HRV during video excerpt 16

**Time–Domain Results**

| Variable | Units | Value |
|---|---|---|
| Mean RR* | (ms) | 915.5 |
| STD RR (SDNN) | (ms) | 8.2 |
| Mean HR* | (1/min) | 65.57 |
| STD HR | (1/min) | 1.12 |
| RMSSD | (ms) | 8.9 |
| NN50 | (count) | 0 |
| pNN50 | (%) | 0.0 |
| RR triangular index | | 2.929 |
| TINN | (ms) | 35.0 |

Looking at B’s relative HF power, Figure 6.22 shows that it was 19.7% in excerpt 16, compared with 21.2% in her previous engagement in ‘Accentuate the Positive’ (see Frequency-Domain Results: AR Spectrum on p.158 in Appendix 16). However, the relative LF powers were still higher in both time segments, suggesting that sympathetic nervous activity still had more influence on B’s heart rate during both excerpts.

Figure 6.22 B’s LF and HF powers during video excerpt 16




| Frequency Band | Peak (Hz) | Power ($ms^2$) | Power (%) | Power (n.u.) |
|---|---|---|---|---|
| VLF (0–0.04 Hz) | 0.0000 | 0 | 0.0 | |
| LF (0.04–0.15 Hz) | 0.0625 | 38 | 65.7 | 65.7 |
| HF (0.15–0.4 Hz) | 0.2813 | 12 | 19.7 | 19.7 |
| Total | | 58 | | |
| LF/HF | | 3.328 | | |

## 6.4 Music therapist-carer communication

From the therapist's observation of B in the therapy sessions, B could become anxious and disoriented as soon as her positive engagement in music or conversations stopped. However, he noted that B was able to access some information and self-knowledge from her semantic memory, such as the names of her sisters and children and her preferences for tea and music. Accessing these known facts appeared to minimise her anxiety and helped to stabilise her mood. Therefore, the music therapist was able to advise the staff on possible coping strategies for B's anxiety, including providing verbal cues to help B access this semantic information.

In addition, the therapist found that when verbal reassurance had failed to offset B's anxiety or apathy, singing and listening to familiar songs or songs with significant meaning, such as 'Red Sails in the Sunset', 'Anniversary Waltz' or 'Early One Morning', could help minimise these symptoms. Singing these songs could also help B retrieve positive autobiographical memories, such as Saturday dances in the church hall and fond memories of her parents. These memories, with the associated positive emotions, seemed to be able to reduce her apathy. The therapist advised the care staff to use these methods to manage B's symptoms, but emphasised that at times these songs could also trigger sadness for B, leading her to thoughts about the negative aspects of wartime and past life events. Therefore, although engaging B in reminiscence and self-expression could be therapeutic, staff would need to be cautious and timely in directing B's attention to the positive aspects of her remote memory. This was often necessary in order to prevent B from becoming low in mood.

## 6.5 Summary of A's and B's responses in the 16 video excerpts

Table 6.8 below summarises the 16 video excerpts from the two studies. The table outlines the techniques employed by the therapist and the clients' respective responses with the corresponding heart rate, interbeat interval (RR interval) and High Frequency power.

In A's video excerpts, A's physiological reponses to music showed a clear dichotomy between uplifting and calming music styles. A's heart rate tended to increase when the therapist employed a fast song with a 4/4 time signature and accented beat (e.g. video excerpts 1 and 3). This increase in heart rate could also be a result of A's active movements, such as hand clapping and singing, which were induced by the therapist's music. In contrast to this, her heart rate decreased when the therapist employed a slow song with a ¾ Waltz time signature and a legato singing timbre (e.g video excerpts 2, 7 and 9). These physiological phenomena appeared to follow the general understanding that reduced heart rate increases the interval between heart beats and hence increased heart rate variability. Therefore, a soothing waltz song sung with a softened timbre appeared to be beneficial to A's psychophysiological state.

However, High Frequency power (increased High Frequency power indicates increased heart rate variability) appeared to be varied, particularly when A was engaged by the therapist's improvisation in video excerpts 4 and 6. Both excerpts showed A's shortened attention span and occurrence of symptom (aberrant vocal noises) whilst the therapist improvised very similarly and used his vocalisations. The difference between these two excerpts was that A was playing the metallophone in excerpt 4, which indicated decreased high frequency power. This may suggest that listening to improvisation rather than engaging in joint instrumental improvisation was more beneficial to A in terms of better psychophysiological health and reduction of symptoms.

Compared with A, the links between B’s behavioural and physiological responses were less clear for categorisation. However, the excerpts showed that the therapist employed singing to ameliorate B’s symptom of apathy and memory recalls to offset B’s emergent anxiety. Generally, reminiscence, which involved B retrieving long term memory, appeared to increase B’s heart rate and reduce the interbeat interval and high frequency power (e.g. video excerpts 11, 12 and13). Whilst this might suggest that reminiscence was not beneficial to B due to reduced heart rate variability, there was observed reduction in anxiety through memory recalls in the video excerpts.

As Table 6.8 only provides 16 examples of the phenomena observed in the video excerpts, it would not suffice to indicate the relationship between both clients’ behaviours and the corresponding physiological responses. Therefore, other phenomena in the complete 4 videoed therapy sessions would also need to be considered in order to clarify this relationship. A further summary of all the observations in the 4 therapy sessions will be presented in Chapter 7.

Table 6.8 Summary of A's and B's responses in 16 video excerpts

| Client A | | | | | Client B | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Session No. | Video No. | Therapist's musical techniques | A's responses | Changes in heart rate | Session No. | Video No. | Therapist's musical & verbal techniques | B's responses | Changes in heart rate |
| 15 | 1 | Played and sang a song with a 4/4 time signature (Hokey Cokey) with an accented beat to generate entrainment | Hand clapping<br><br>Focused eye gaze at the therapist | Increased heart rate<br><br>Decreased RR interval<br><br>Decreased High Frequency power | 11 | 10 | Keyboard accompaniment to B's singing a song with significant personal meaning (Red Sails in the Sunset)<br><br>Change of tempo and style (foxtrot) | Singing<br><br>Smiling<br><br>Closed sitting posture<br><br>Memory recall as the song ended | Decreased heart rate<br><br>Increased RR interval<br><br>Increased High Frequency power |
| 15 | 2 | Played and sang a slow song with a ¾ time signature (The Ash Grove) to generate a calming effect | Settled in mood<br><br>Thoughtful facial expression whilst listening<br><br>Eye contact | Decreased and stable heart rate<br><br>Increased RR interval<br><br>Decreased High Frequency | 11 | 11 | Used verbal cues to help B retrieve semantic and autobiographical memory about her family | Symptom(anxiety) reduced when attending to semantic and autobiographical recalls about her family | Increased heart rate<br><br>Decreased RR interval<br><br>Decreased High Frequency power |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | during the song<br><br>Smiled as the song ended | power | | | | | |
| 16 | 3 | Incorporated pauses in the improvised sections of the song ‘Little Brown Jug’ to generate a call-and-response game | Hand clapping<br><br>Singing<br><br>Smiling | Changeable and high heart rate<br><br>Changeable and decreased RR interval<br><br>Decreased High Frequency power | 11 | 12 | Used verbal cues to help B retrieve semantic memory about her son and herself | Symptom (anxiety) reduced when attending to semantic recalls about her son and herself | Changeable and increased heart rate<br><br>Decreased RR interval<br><br>Low and decreased High Frequency power |
| 16 | 4 | Improvised keyboard playing (downward melodic contour, sustained notes and a regular pulse) | Metallophone playing<br><br>Presence of symptom (aberrant vocal noises)<br><br>Shortened attention span | Decreased heart rate<br><br>Increased RR interval<br><br>Decreased High Frequency power | 17 | 13 | Used verbal cues to help B attend to the positive aspects of long-term memory about the war<br><br>Incorporated humour, laughter and | Displayed sadness when the song ‘Red Sails in the Sunset’ triggered sad memories about the war<br><br>Reduced sadness when attention was diverted to positive long-term | Increased heart rate<br><br>Decreased RR interval<br><br>Decreased High Frequency power |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | surprise into verbal expressions | memory | |
| 16 | 5 | Played and sang ‘Early One Morning’ to generate a calming and tender feeling<br><br>Sped up the song, changing it to a foxtrot style and using a percussive timbre on the keyboard | Sitting calmly and listening receptively<br><br>Staring straight<br><br>Entraining movements<br><br>Settled in mood as the song ended | Stable heart rate and RR interval<br><br>Increased High Frequency power | 17 | 14 | Used a song with a 4/4 time signature, a series of major-third intervals and rise and falls of melodic contour (Early One Morning) to uplift spirit | Joined in singing after initial signs of lethargy<br><br>Eye contact<br><br>Smiling | Changeable and increased heart rate<br><br>Changeable and decreased RR interval<br><br>Increased High Frequency power |
| 17 | 6 | Improvised keyboard playing with a regular pulse and vocalisations | Presence of symptom (aberrant vocal noises)<br><br>Shortened attention span<br><br>Entraining movements | Decreased heart rate<br><br>Increased RR interval<br><br>Increased High Frequency power | 18 | 15 | A song with personal meaning to promote memory recall | Repetitive verbal content<br><br>Retrieving positive long term memory triggered by the meaningful song | Very slightly increased heart rate and decreased RR interval<br><br>Decreased High Frequency power |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | 7 | Played and sang a calming known song with a ¾ time signature (Now is the Hour)<br><br>Soft singing timbre and broken chords and reduced texture on the keyboard | Settled in mood<br><br>Thoughtful facial expression<br><br>Listening whilst staring into space<br><br>Smiled and clapped her hands as the song ended | Slightly decreased heart rate<br><br>Slightly Increased RR interval<br><br>Increased High Frequency power | 19 | 16 | Directing B's attention to the positive aspects of autobiographical memory in order to prevent emergent anxiety | Reminiscing long-term memory about the war and her husband | Reduced heart rate<br><br>Increased RR interval<br><br>Slightly increased High Frequency power |
| 18 | 8 | Played and sang 'Daisy Bell' (3/4 time signature) but moved into improvisation with variable accents, tempi and major/ minor keys | Attending to the changes in the therapist's music and changing her music playing on the drum and cymbal<br><br>Brief presence of symptom (aberrant vocal noises) | Decreased heart rate<br><br>Increased RR interval<br><br>Slightly Increased High Frequency power although relatively | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | low (23.5%) | | | | | |
| 18 | 9 | A song with a ¾ time signature (Golden Slumbers) and improvisation to generate calming and tender feelings<br><br>Broken chords, reduced musical texture and legato melodic phrasing on the keyboard | Settled in mood<br><br>Receptive listening<br><br>Pensive facial expression | Reduced heart rate<br><br>Increased RR interval<br><br>Increased High Frequency power | | | | | |

# Chapter 7 Results: Summary of A and B’s behaviours, heart rate and heart rate variability

## 7.1 Introduction

Following on from Chapter 5 and 6, which detailed the behavioural and physiological phenomena in A and B’s video excerpts, the current chapter provides a comprehensive view of all other phenomena as part of the case study. The chapter firstly presents how A and B spent their time on various identified behaviours in their respective four therapy sessions. Further, the chapter outlines the indices of heart rate and heart rate variability that are linked to these behaviours. These indices include mean inter-beat interval (mean RR), mean standard deviation of inter-beat interval (mean SDNN), mean heart rate (mean HR), mean heart rate standard deviation (mean HR STD) and mean relative power of high frequency band (mean relative HF power). Additionally, the chapter outlines three other indices, which were used to assess the effect of music therapy sessions by comparing the pre-and post-session data. These three indices include square root of the mean squared differences between successive inter-beat intervals (RMSSD), NN50 divided by the total number of inter-beat intervals (pNN50) and absolute power of high frequency band (Absolute HF power). The high and low values of these indices suggest the dominance of either sympathetic or parasympathetic nervous activity, which were previously outlined in section 3.6.5 and Table 3.3 in Chapter 3 Methods. The current chapter concludes by presenting two tables. Table 7.3 outlines the highest and lowest values of these indices linked to the behaviours. Table 7.3 was subsequently used to select the 16 video excerpts outlined in Table 7.4. The method of selecting video excerpts was also detailed in section 3.6.5 in Chapter 3.

## 7.2 Behaviours in therapy sessions

Four videoed music therapy sessions for two residents, participant A and participant B, were analysed to determine the residents' responses to musical input and then compared to the heart rate analysis. After using the excel sheet to segment the times between the start of the therapist's sensory input and the end of the client's response to the input, the results of the heart rate analysis were produced in accordance with these time segments. These time segments were different lengths in duration. Excluding the ones that were less than 1 minute (as reliable frequency domain analysis requires more than 1 minute of data), 37 time segments for participant A and 33 for participant B in total were identified from the respective 4 therapy sessions. These time segments, displaying either a single behaviour or a series of behaviours, were then grouped in to different categories based on how behaviours changed from one to another in the order of time. For example, participant A could be solely receptively listening to the therapist's music playing throughout a time segment. This time segment would be categorised into 'Listening'. When participant A started with entrainment, such foot tapping, but then changed to singing and back again to foot tapping, the time segment would be categorised into 'Move/Voice/Move'. In total, 10 behavioural categories were identified for participant A and 9 for participant B. Table 7.1 and 7.2 present these behavioural categories for each participant. The table includes the behavioural category descriptions, the number of time segments identified for each and the time spent on each (which was calculated by adding up the time of the identified segments within each category).

Table 7.1 Ten behavioural categories for participant A

| Behavioural category | Description | Number of time segments | Time spent |
|---|---|---|---|
| Movement | Entrainment including clapping, foot tapping and other active movements in response to rhythmic inputs. | 14 | 31 min 22 sec |
| Listening | Receptively listening to the therapist’s music inputs, such as singing, keyboard accompaniment or improvisation. | 7 | 14 min 50 sec |
| Instrument | Improvising on the instruments including the xylophone, drum and cymbal. | 4 | 8 min 11 sec |
| Movement/Listening | Started responding with entrainment but subsequently changed to receptive listening to the therapist’s music inputs. | 4 | 9 min 2 sec |
| Listening/Movement | Initial receptive listening changed to entrainment. | 2 | 5 min 26 sec |
| *Movement/Instrument | Initial entrainment changed to improvisation. | 1 | 3 min 18 sec |
| *Instrument/Movement | Initial improvisation changed to entrainment | 1 | 1 min 39 sec |
| *Voice/Movement | Initial active singing or vocalisations changed to entrainment. | 1 | 2 min 4 sec |
| *Move/Voice/Move | Entrainment changed to | 1 | 2 min 29 sec |

| | | | |
|---|---|---|---|
| | singing/vocalisations and changed back to entrainment. | | |
| Mixture | More than 3 behaviours, involved in a time segment, such as changing from improvisation to receptive listening, singing, entrainment, and improvisation again and finally to singing. | 2 | 7 min 32 sec |

*single time segment

Table 7.2 Nine behavioural categories for participant B

| Behavioural category | Description | Number of time segments | Time spent |
|---|---|---|---|
| Talking | General conversations between the therapist and participant B, such as greetings at the beginning of a session and participant B answered “yes” when offered a cup of tea. | 2 | 4 min 8 sec |
| Voice | Singing along with the therapist’s singing and piano accompaniment. | 3 | 4 min 34 sec |
| Reminiscence | Retrieving past memories about personal or family events. | 4 | 7 min 2 sec |
| Reminiscence/Talking | Initial reminiscence changed to general conversations. | 4 | 10 min |
| Reminiscence/Voice | Reminiscence led to singing | 2 | 5 min 5 sec |
| Voice/Reminiscence | Singing led to reminiscence | 2 | 8 min 23 sec |
| Talking or Reminiscence/Anxiety | Alternating between talking and reminiscing whilst showing signs of anxiety i.e., being disorientated in time and space, worrying that her family could not find her. | 2 | 26 min 59 sec |
| Listening/Voice | Receptive listening to the therapist’s singing and piano accompaniment lead to active singing or repeating the same sequence. | 7 | 15 min 31 sec |

| | | | |
|---|---|---|---|
| Voice/Listening | Active singing led to receptive listening to the therapist's singing and piano accompaniment. | 7 | 15 min 07 sec |

Figure 7.1 below presents Table 7.1 in graphical form. 7 out of participant A's 10 identified behaviours involved movements, which entrained to the musical beat. The majority of participant A's time was also spent on entraining to the rhythmic inputs from the therapist. This was 25% (31.22 minutes) of the total added time (125.58 minutes) of the 37 segments. This highest percentage of time was followed by receptive listening to the therapist's music inputs (12%), entrainment leading to passive listening to music (7%). and improvisation (6%). The least time was spent on improvisation that led to entrainment. This was 1% (1.39 minutes) of the total added time.

Figure 7.1 A's time spent in ten identified behaviours over the four therapy sessions

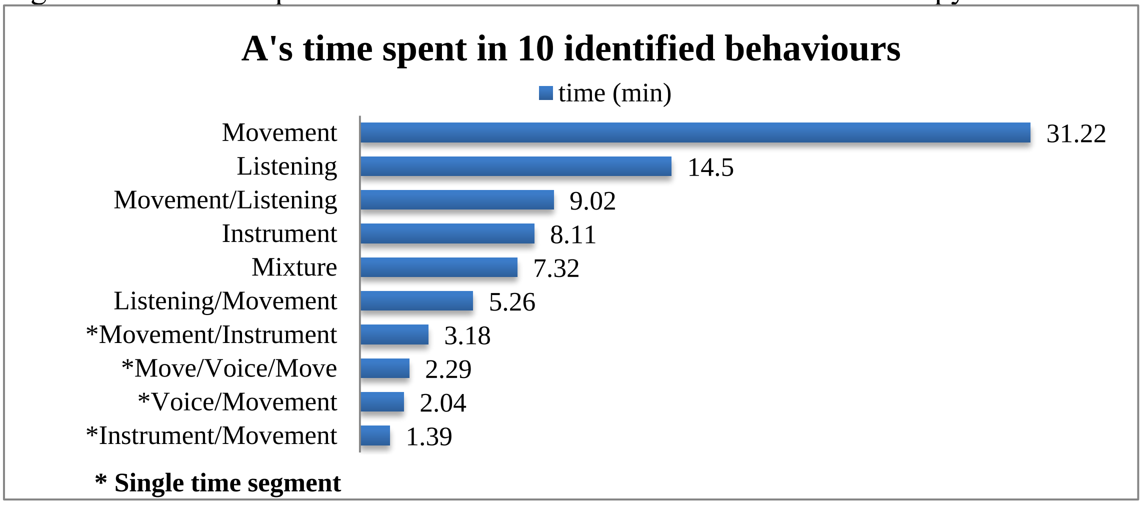
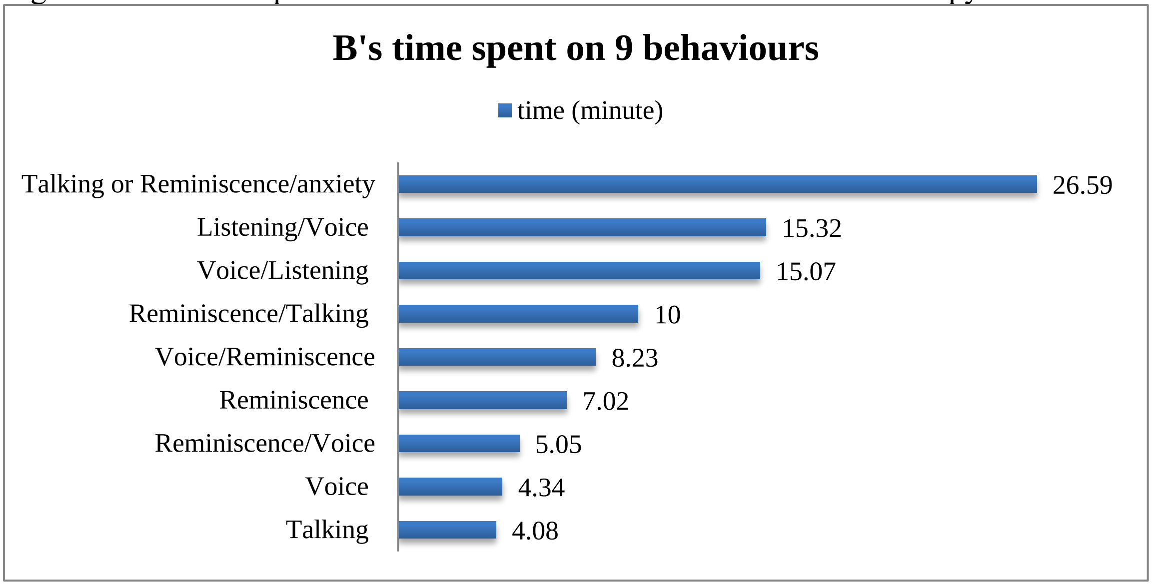



Figure 7.2 below displays Table 7.2 in graphical form. 6 out of the 9 identified behaviours involved participant B's verbalisations, either holding general conversations with the therapist or reminiscing. Participant B spent 19% (26.59 minutes) of the total added time of the 33 segments (137.35 minutes) on talking generally or reminiscing whilst showing signs of anxiety. This highest percentage was followed by receptive

listening to the therapist's music inputs, which led to active singing (15.32 minutes; 11%) or vice versa (15.07 minutes; 11%). The least time was spent on general conversations (4.08 minutes; 3%).

Figure 7.2 B's time spent in nine identified behaviours over the four therapy sessions



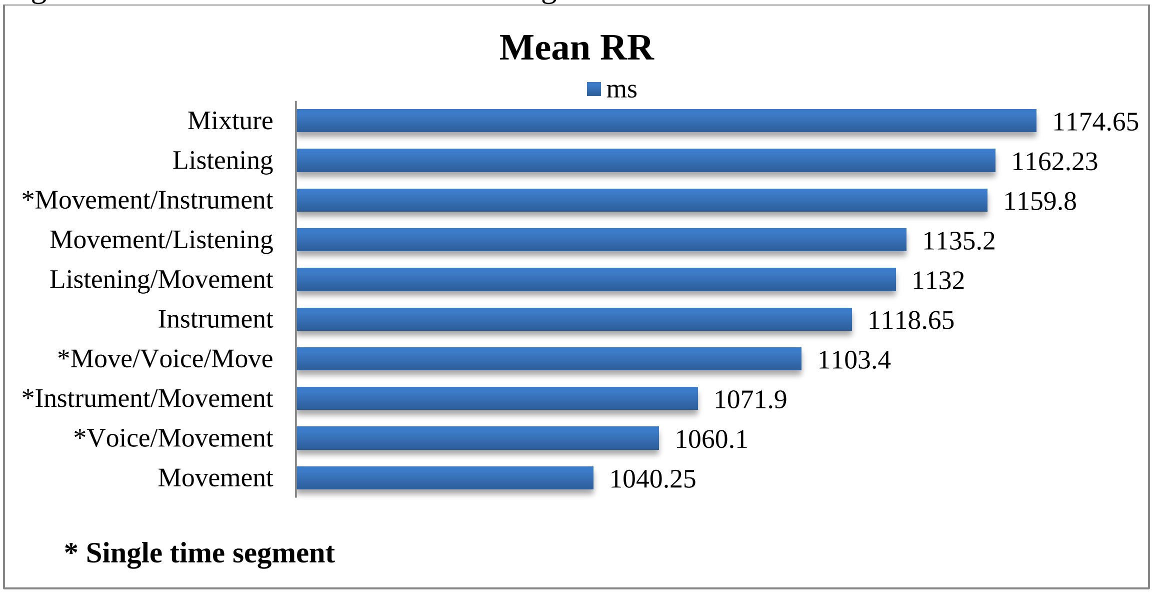

## 7.3 Results of heart rate and heart rate variability analysis of the behaviours

Having identified A and B's behaviours in their respective four therapy sessions, the following section will present the results of the heart rate analysis concerning the mean inter-beat interval (mean RR), mean standard deviation of inter-beat interval (mean SDNN), mean heart rate (mean HR), mean standard deviation of heart rate (mean HR STD) and mean relative power of high frequency band (mean relative HF power) for each identified behaviour.

### 7.3.1 Mean RR (Mean inter-beat interval)

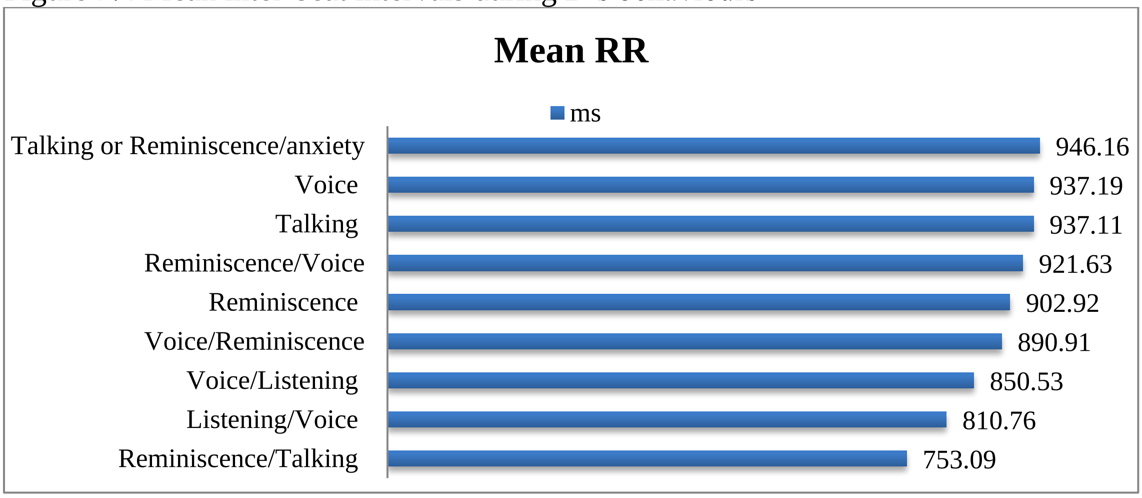
Figure 7.3 below displays the mean RR for each of A's behaviours in milliseconds (ms). The highest mean RR was found when A was engaged in a mixture of more than three behaviours, including improvisation, singing/vocalisations, entrainment and listening to the therapist's music inputs (1174.65 ms). The lowest mean RR was found when A was responding to the therapist's music with entraining movements (1040.25 ms).

Figure 7.3 Mean inter-beat intervals during A's behaviours




For participant B (Figure 7.4), the highest mean RR was displayed by the behaviour involving alternating between general conversations and reminiscence whilst showing signs of anxiety and disorientation (946.16 ms). This was followed by singing (937.19 ms) and general conversations (937.11 ms). The lowest mean RR was displayed by her reminiscence, leading to general conversations (753.09 ms).

Figure 7.4 Mean inter-beat intervals during B's behaviours




### 7.3.2 Mean SDNN (Mean standard deviation of inter-beat interval)

Figure 7.5 below present the mean standard deviation of inter-beat interval for each of A's behaviours in millisecond (ms). The highest mean SDNN was displayed by the behaviour involving A's singing or vocalisations between the time periods of entraining to the therapist's music (23.22 ms). The lowest mean SDNN was during the time of A's vocalisation, leading to entrainment (12.3 ms).

Figure 7.5 Mean standard deviations of inter-beat intervals during A's behaviours

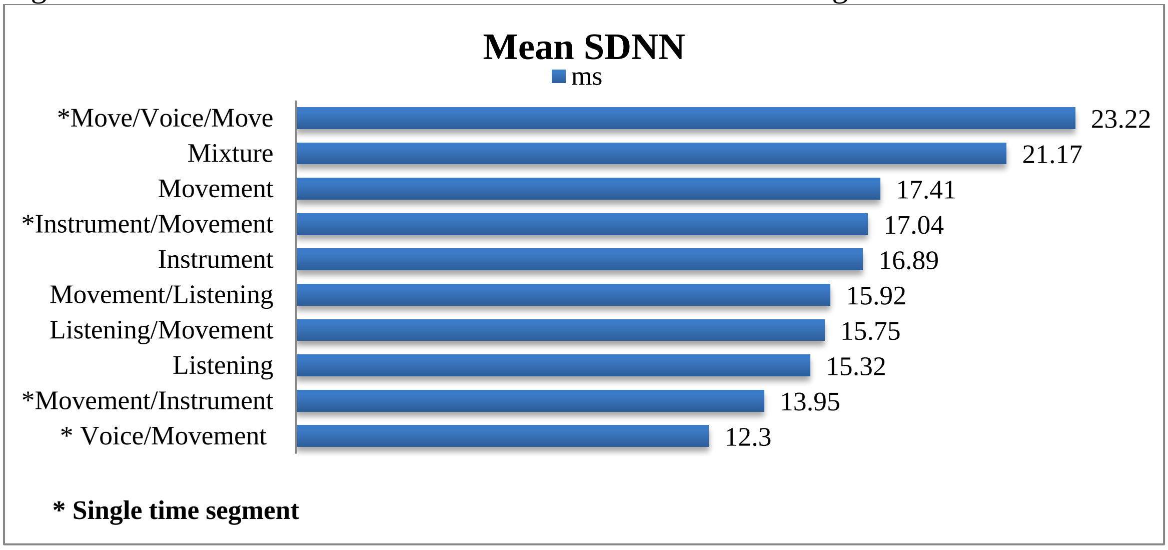
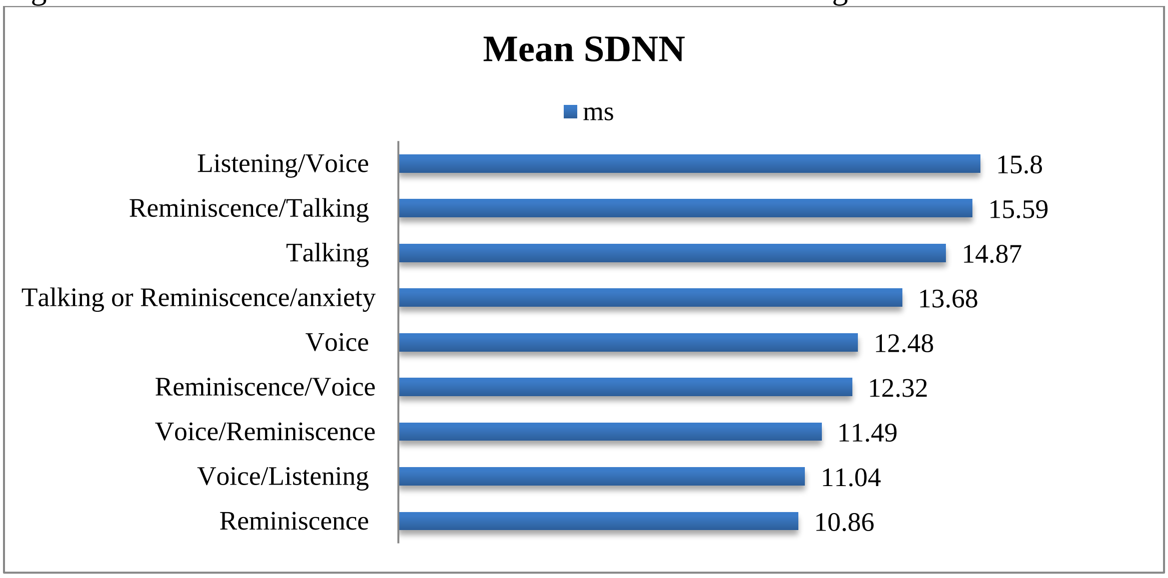



Figure 7.6 presents the mean standard deviations of inter-beat interval for B's behaviours. The highest mean SDNN was found in the behaviour involving B initially reminiscing but later joining in with singing (15.80 ms). The lowest mean SDNN was found in the behaviour where B was reminiscing (10.86 ms).

Figure 7.6 Mean standard deviations of inter-beat intervals during B's behaviours



### 7.3.3 Mean HR (Mean heart rate)

Figure 7.7 presents the mean heart rate (bpm: beat per minute) for each of A's behaviours. The highest mean HR was found during the time when A engaged in entraining to the therapist's music inputs (58.2 bpm). The lowest mean HR was during the time when A engaged in a series of behaviours (51.31 bpm), starting with improvisation, followed by listening to therapist's music and singing, and leading to listening to music or improvisation or singing again.

Figure 7.7 Mean heart rates during A's behaviours

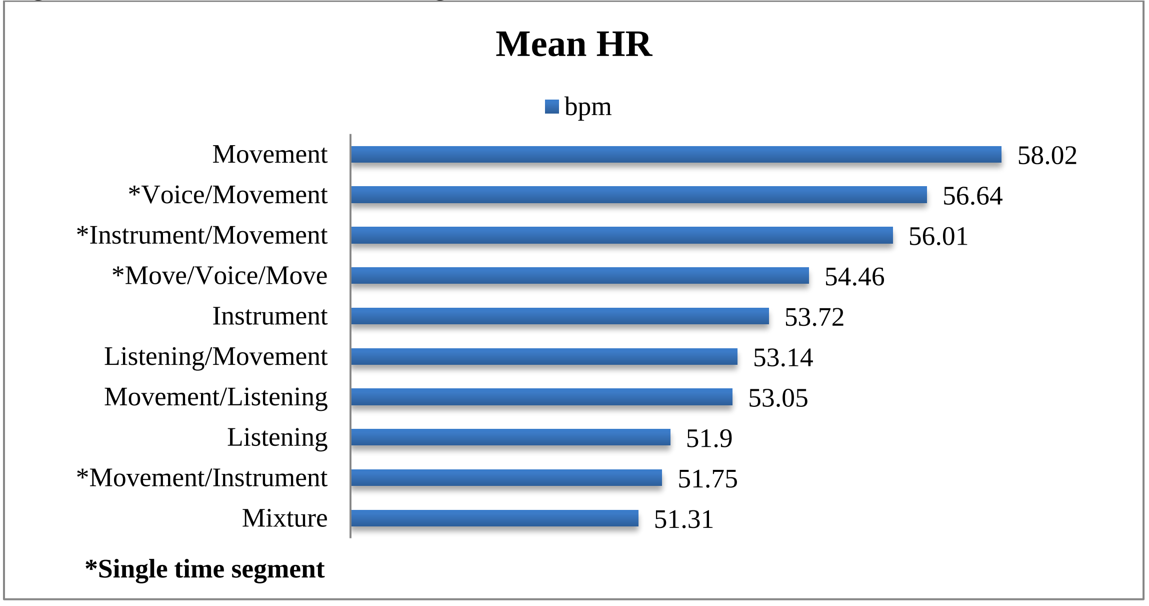
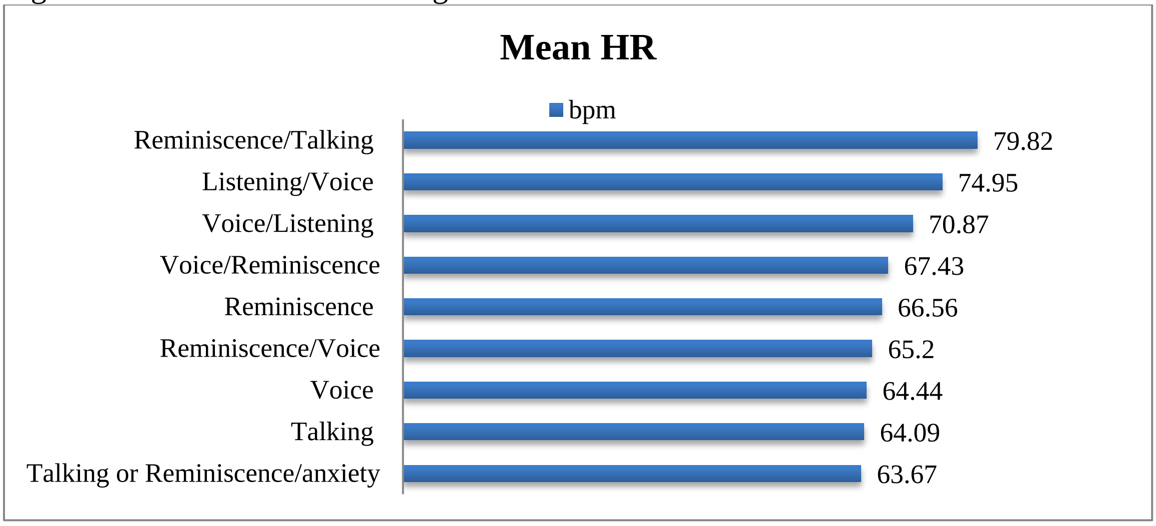



Figure 7.8 displays the mean HR for each of B's behaviours. When B engaged in reminiscence, followed by general chatting, her mean HR was at the highest level (79.82 bpm). Her mean HR was at the lowest level (63.67 bpm) when she was showing signs of anxiety whilst alternating between chatting generally and reminiscing.

Figure 7.8 Mean heart rates during B’s behaviours




### 7.3.4 Mean HR STD (Meant standard deviation of heart rate)

Figure 7.9 displays the mean standard deviation of heart rate for each of A’s behaviours. The highest mean HR STD (1.36 bpm) was found during the time when A engaged in entrainment, followed by vocalisations and entrainment. The lowest mean HR STD (0.82 bpm) was found during the time when A was entraining to the therapist’s music inputs and moving on to improvising on the instruments.

Figure 7.9 Mean heart rate standard deviations during A’s behaviours

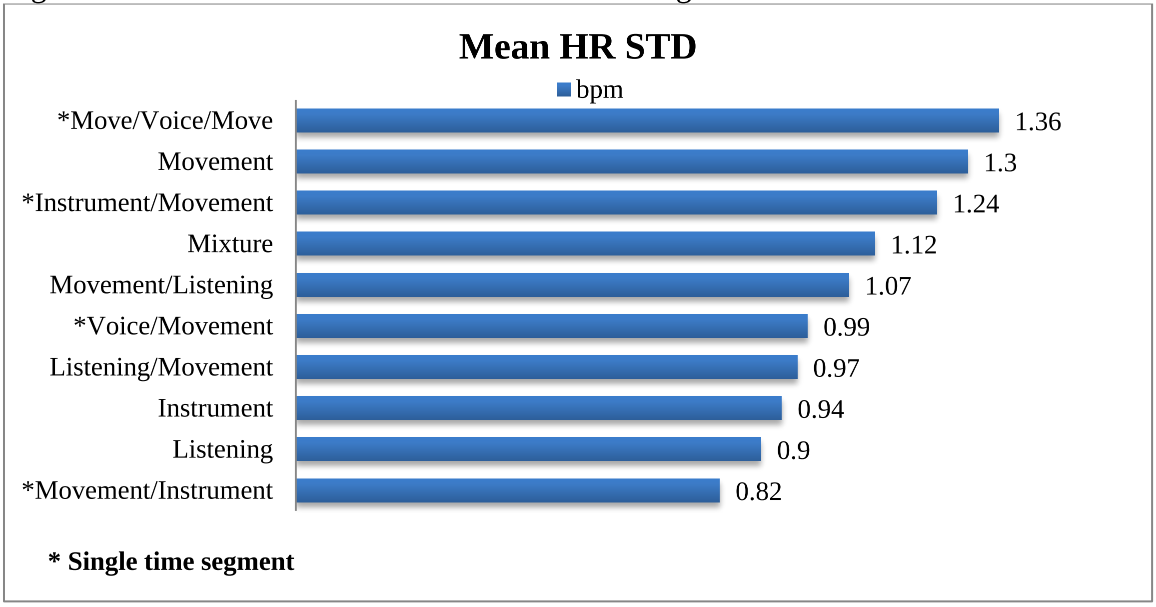
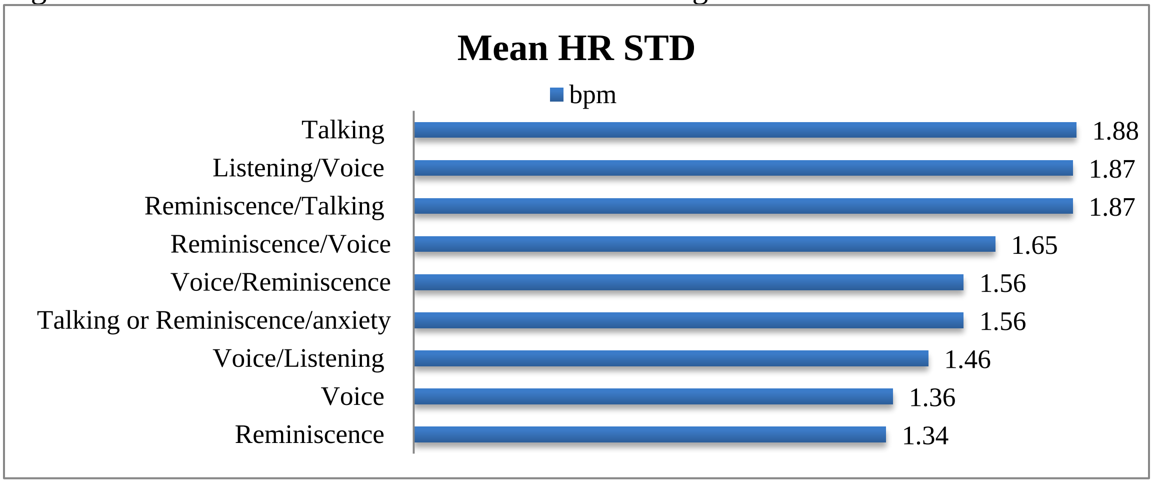


Figure 7.10 below displays the mean HR STD of B's behaviours. General conversations were found to have the highest mean HR STD (1.88 bpm) whilst reminiscence had the lowest HR STD (1.34 bpm).

Figure 7.10 Mean heart rate standard deviations during B's behaviours




### 7.3.5 Mean relative HF power (Mean relative power of high frequency band)

In terms of the mean relative HF power (Figure 7.11), A displayed the highest power when she engaged in listening to the therapist's music, which then activated her entraining movements (84.73%). This highest power was followed by her vocalisations, which led to entraining movements (52.23%), and her instrumental improvisation, which also led to entraining movements (50.93%). Entrainment changing to instrumental improvisation displayed the lowest mean relative HF power (28.29%).

Figure 7.11 Mean relative powers of high frequency band during A’s behaviours

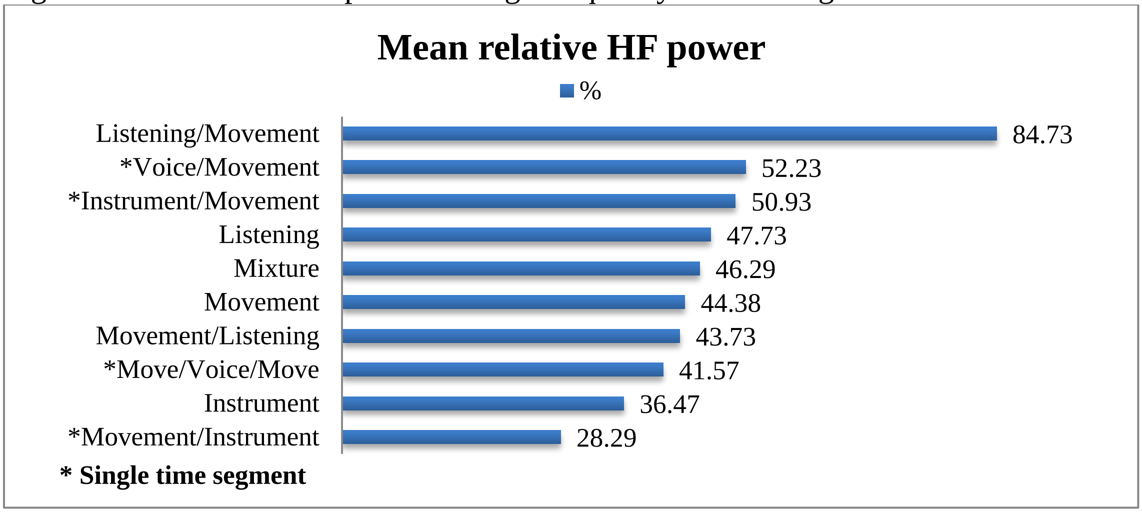
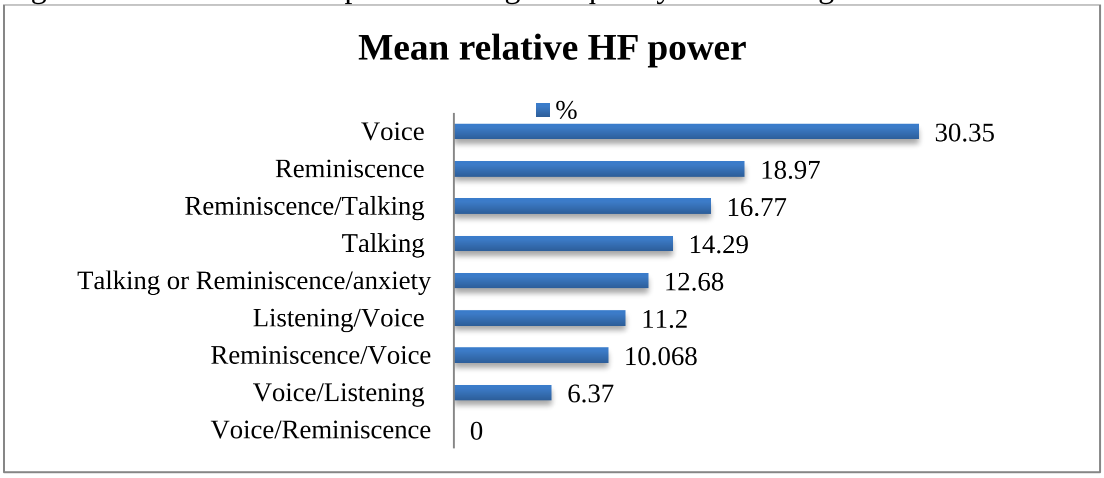



Figure 7.12 shows that B’s highest mean relative HF power was found during her singing (30.35%). This highest mean was followed by reminiscence (18.97%) and reminiscence changing to general conversations (16.77%). No relative HF power (0%) was detected by the autoregressive spectrum analysis for the behaviour of singing, which led to reminiscence.

Figure 7.12 Mean relative powers of high frequency band during B’s behaviours




## 7.4 Results of heart rate variability analysis of pre- and post- session data

This section presents the changes in RMSSD (square root of the mean squared differences between successive RR intervals), pNN50 (NN50 divided by the total number of RR intervals) and absolute HF power (absolute power of high frequency band) before and after individual music therapy sessions. These differences are presented in graphical form across the 4 therapy sessions for each of the two residents.

### 7.4.1 RMSSD (square root of the mean squared differences between successive RR intervals)

Figure 7.13 indicates that A's RMSSD, counted in milliseconds (ms), decreased after each therapy session.

Figure 7.13 A's four sets of pre- and post-session RMSSD

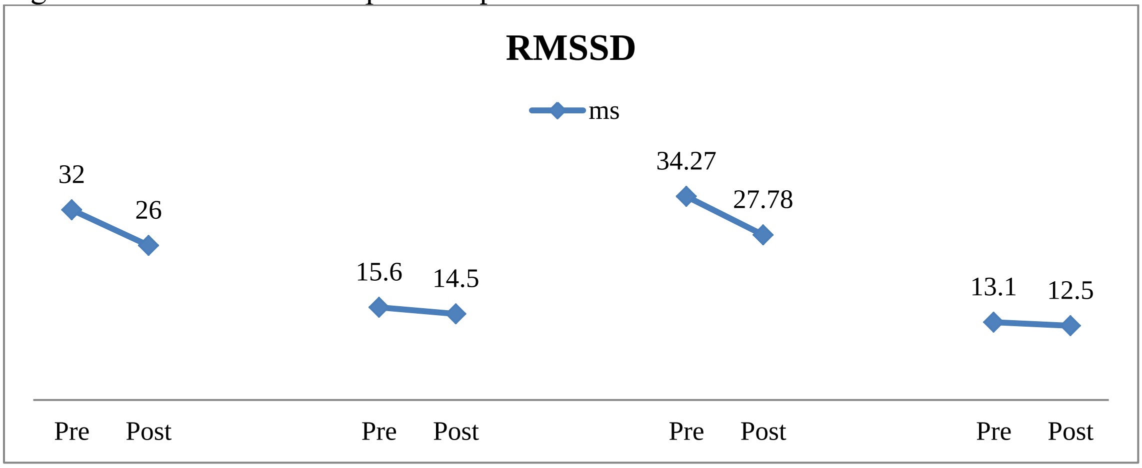
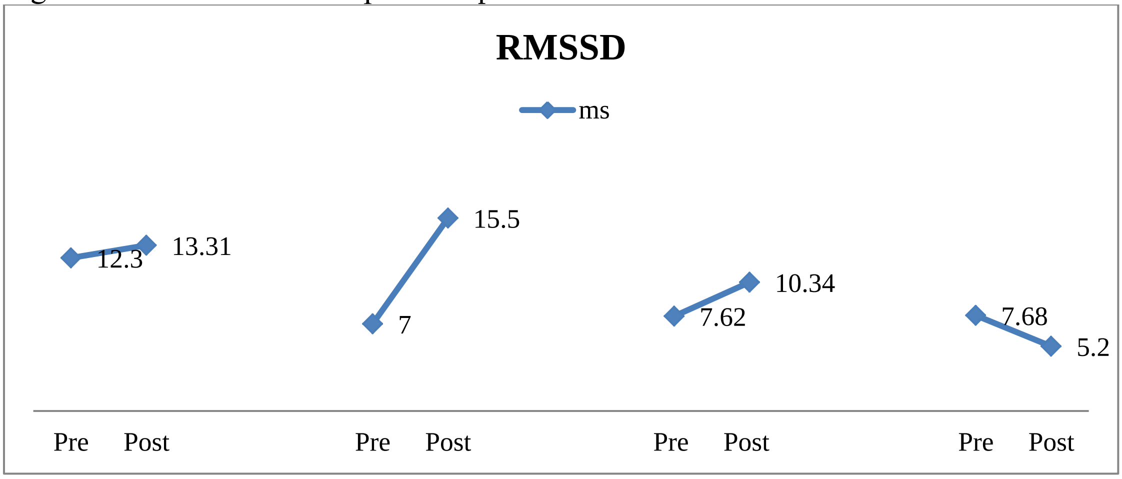



Figure 7.14 below shows the RMSSD for participant B.  One session displayed a decrease whereas the other 3 sessions displayed an increase in RMSSD.

Figure 7.14 B's four sets of pre- and post-session RMSSD




### 7.4.2 pNN50 (NN50 divided by the total number of RR intervals)

Figure 7.15 presents the percentage of pNN50 for A. Three of A's therapy sessions displayed a decrease in pNN50. One session did not detect the presence of pNN50.

Figure 7.15 A's four sets of pre- and post-session pNN50

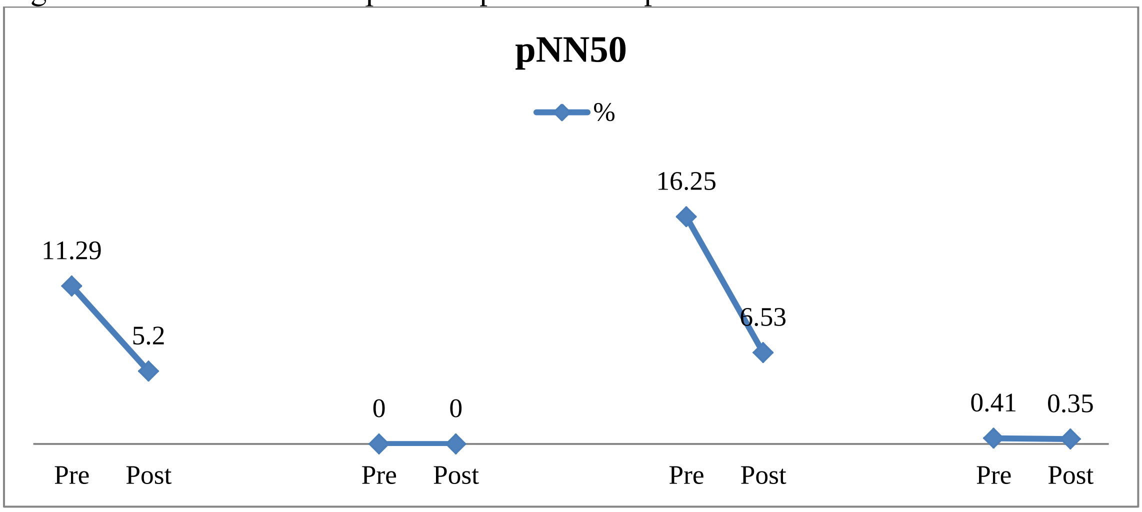
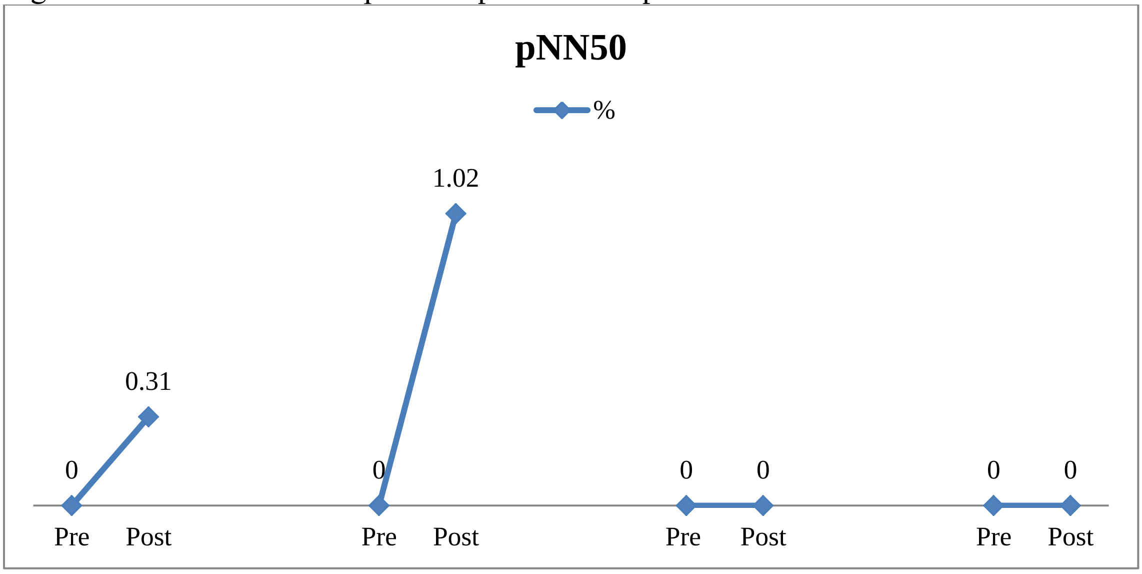



Figure 7.16 below indicates that participant B's pNN50 increased from no detected pNN50 at baseline to 0.31 (%) and 1.02 (%) respectively for two therapy sessions. The other two sessions did not detect pNN50.

Figure 7.16 B's four sets of pre- and post-session pNN50




### 7.4.3 Absolute HF power (absolute power of high frequency band)

Figure 7.17 presents the comparison of absolute high frequency powers (HF) of A's pre and post therapy periods. HF decreased after all four therapy sessions.

Figure 7.17 Absolute high frequency powers of A's pre and post therapy periods

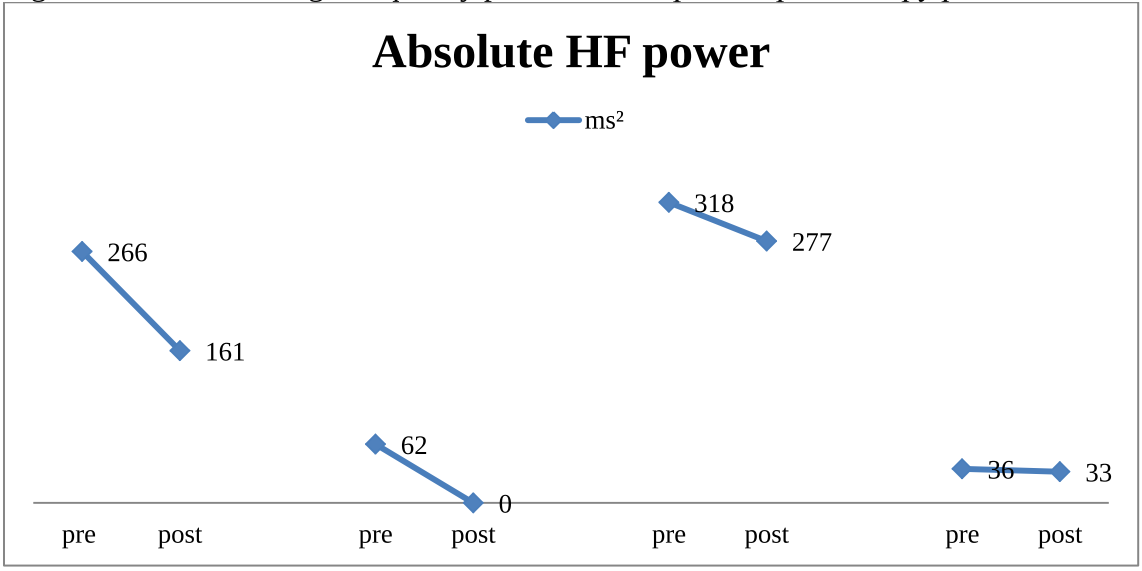
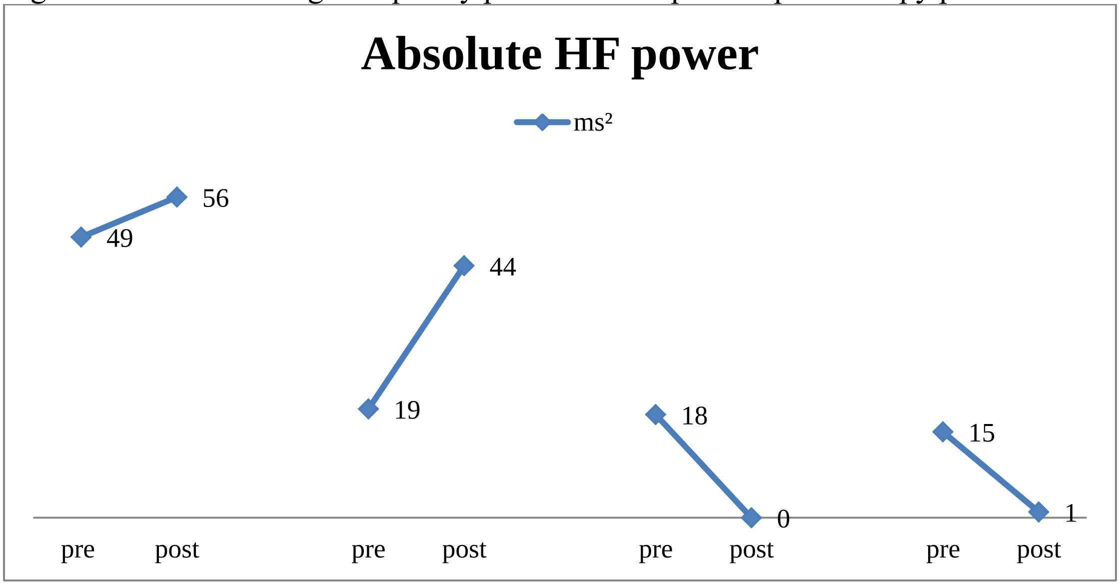



Figure 7.18 shows that B's HF increased after two earlier sessions whilst decreased after the final two sessions.

Figure 7.18 Absolute high frequency powers of B's pre and post therapy periods




## 7.5 16 selected short video excerpts

The results from the heart rate analysis allowed for the identification of the particular behaviours (Table 7.3) that displayed the highest and lowest values of the mean RR, mean SDNN, mean HR, mean HR STD and mean relative HF power. Some of these behaviours, such as *Mixture* and *Movement* for A and *Reminsicence/Talking* and *Talking or reminiscence/anxiety* for B, are repeated in the table as they displayed the highest and lowest values of more than one index of heart rate and heart rate variability.

Table 7.3 Highest and lowest indices of heart rate/heart rate variability associated with behaviours

| Participant | A | B |
|---|---|---|
| Highest mean RR | Mixture<br>1174.65 ms | Talking or reminiscence/anxiety<br>946.16 ms |
| Lowest mean RR | Movement<br>1040.25 ms | Reminiscence/Talking<br>753.09 ms |
| Highest mean SDNN | Mixture<br>21.17 ms | Listening/Voice<br>15.80 ms |
| Lowest mean SDNN | Listening<br>15.32 ms | Reminiscence<br>10.86 ms |
| Highest mean HR | Movement<br>58.02 bpm | Reminiscence/Talking<br>79.82 bpm |
| Lowest mean HR | Mixture<br>51.31 bpm | Talking or reminiscence/anxiety<br>63.67 bpm |
| Highest mean HR STD | Movement<br>1.3 bpm | Talking<br>1.88 bpm |
| Lowest mean HR STD | Listening<br>0.9 bpm | Reminiscence<br>1.34 bpm |
| Highest mean relative HR power | Listening/Movement<br>84.73% | Voice<br>30.35% |
| Lowest mean relative HR power | Instrument<br>36.47% | Voice/Reminiscence<br>0% |

As mentioned earlier in section 7.2, both participants' behaviours in therapy were identified based on the groupings of the time segments. Some of these behaviours consisted of one single time segment and, therefore, were excluded from Table 7.3 as they did not produce a mean for the indices of heart rate and heart rate variability. The behaviours, listed in Table 7.3, all comprised at least two time segments. As a result, the time segments indicating the highest and lowest values within each of these behaviours were selected as the video excerpts for video observation. Table 7.4 below presents the 16 selected video excerpts. Initially, 15 video excerpts were selected (8 for A and 7 for B). However, one additional excerpt (No. 4) was selected for A, as this was the only excerpt showing A's active engagement in joint improvisation with the therapist. In addition, this excerpt also had physiological relevance as it displayed a high value of low and high frequency ratio using the Fast Fourier Transformation analysis (LF/HF=1.31) and using the Autoregressive Spectral analysis (LF/HF=2.12). The 16 video excerpts were analysed qualitatively within the framework of hermeneutic phenomenology. The results of the hermeneutic analysis are presented in the following chapter.

Table 7.4 Descriptions of the16 selected video excerpts

| Excerpt number | Resident | Session | Date | Camcorder time: Start/End time | | Physiological relevance | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 15 | 04/07/2013 | 6min07 | 7min11 | Mean RR | Low | Mean HR | High |
| 2 | A | 15 | 04/07/2013 | 16min50 | 18min30 | Mean SDNN | Low | | |
| 3 | A | 16 | 10/07/2013 | 4min27 | 7min53 | Mean HR STD | High | | |
| 4 | A | 16 | 10/07/2013 | 15min36 | 18min53 | LF/HF | High | | |
| 5 | A | 16 | 10/07/2013 | 23min34 | 26min10 | Mean HF power | High | | |
| 6 | A | 17 | 17/07/2013 | 17min15 | 20min14 | Mean RR | High | Mean SDNN | High |
| 7 | A | 17 | 17/07/2013 | 28min54 | 30min36 | Mean HR | Low | | |
| 8 | A | 18 | 18/07/2013 | 8min11 | 11min15 | Mean HF power | Low | | |
| 9 | A | 18 | 18/07/2013 | 24min31 | 25min51 | Mean SDNN | Low | | |
| 10 | B | 11 | 22/05/2013 | 1min23 | 3min04 | Mean HF power | High | | |
| 11 | B | 11 | 22/05/2013 | 3min32 | 6min59 | Mean RR | High | Mean HR | Low |
| 12 | B | 11 | 22/05/2013 | 27min03 | 28min29 | Mean HR STD | High | | |
| 13 | B | 17 | 10/07/2013 | 3min46 | 5min35 | Mean RR | Low | Mean HR | High |
| 14 | B | 17 | 10/07/2013 | 5min55 | 7min31 | Mean SDNN | High | | |
| 15 | B | 18 | 17/07/2013 | 22min02 | 24m44 | Mean HF power | Low | | |
| 16 | B | 19 | 18/07/2013 | 31min06 | 32min21 | Mean SDNN | Low | Mean HR STD | Low |

# Chapter 8 Results: Hermeneutic analysis of 16 video excerpts

## 8.1 Introduction

The hermeneutic analysis was initially carried out by a cognitive psychologist and the music therapist, who wrote down their visual observations of the video excerpts (see section 3.6.6 for detailed procedure of video observation). A video analysis form was designed to suit this purpose (see Table 3.4 in Chapter 3), and was used by the psychologist and music therapist to collect raw data of written text. As there were 16 video excerpts, the psychologist and music therapist each produced 16 sets of written observations. These 32 sets of written observations amounted to a total of 64 pages of raw data. Using the software NVivo 10, the author of the current study coded the raw data based on the framework of hermeneutic phenomenology proposed by Van Manen (1997). This framework helped to identify how the therapy sessions might work by delving into temporal, corporeal and relational themes, as discussed in section 3.6.6. The results of these three themes are summarised below:

## 8.2 Temporal themes

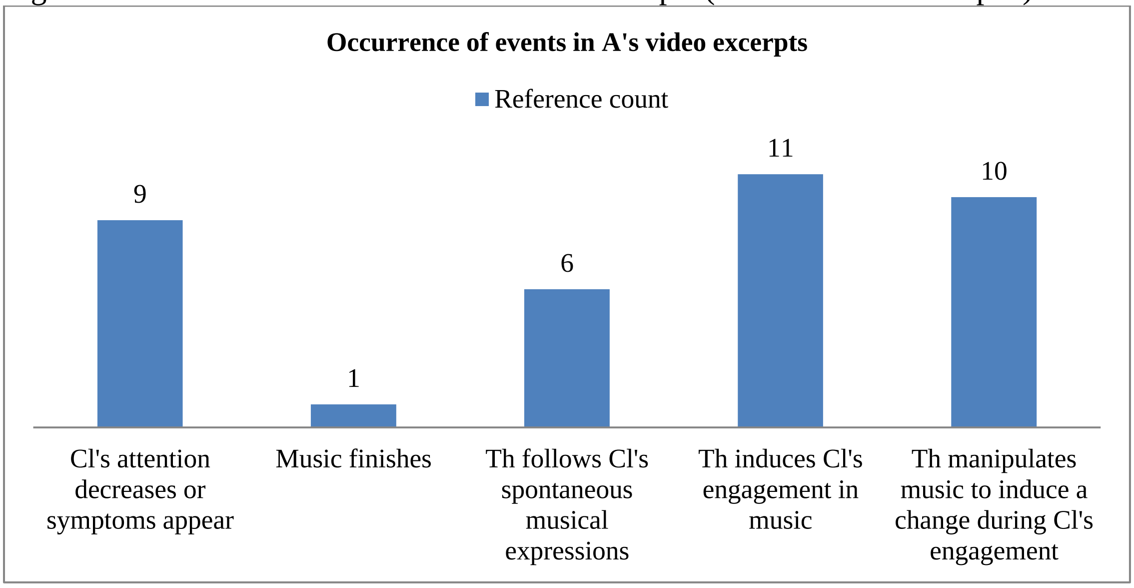
Table 8.1 presents the 5 major temporal themes. These themes were established by coding the times when events occurred during which the therapist needed to intervene verbally, musically or nonverbally. Table 8.1 indicates that the most references (45) were made to times when the clients' attention wavered or symptoms appeared. The sources are the number of sets of video analysis and references are the codes made into the themes.

Table 8.1 Five temporal themes (Cl: Client/Th: Therapist)

| **Temporal themes** | **Sources** | **References** |
|---|---|---|
| Cl's attention decreases or symptoms appear | 15 | 45 |
| Th induces Cl's engagement in music | 10 | 14 |
| Music finishes | 6 | 12 |
| Th manipulates music to induce a change during Cl's engagement | 4 | 10 |
| Th follows Cl's spontaneous musical expressions | 4 | 6 |

By using the matrix coding function in NVivo 10, Figure 8.1 was produced, which indicates that events in A's excerpts often occurred when the therapist used music to generate A's engagement (11 references). This was followed by times when the therapist manipulated the elements of music to induce a change during A's engagement (10 references). One reference was made to the time when the music finished; the therapist spoke to A generally after they finished a joint-improvisation.

Figure 8.1 Occurrence of events in A's video excerpts (Cl: Client/Th: Therapist)



Figures 8.2, 8.3, 8.4 and 8.5 provide further details regarding each of the times presented in Figure 8.1.

Figure 8.2 A’s attention decreases and symptoms appear

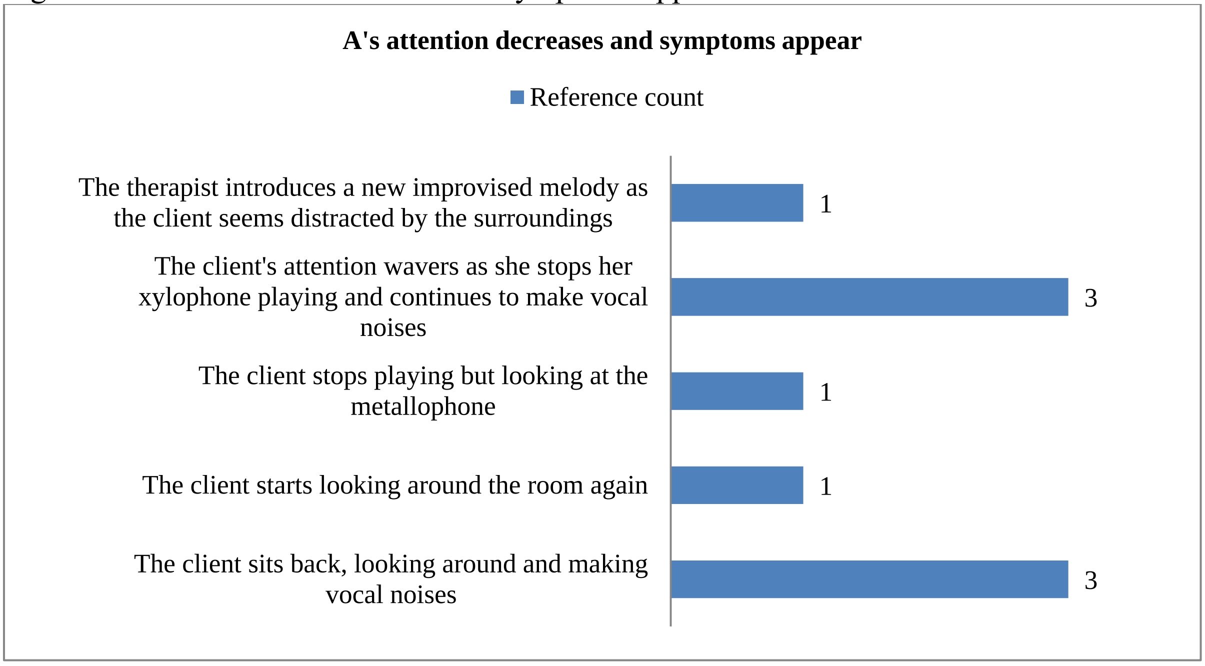



Figure 8.3 Therapist follows A’s spontaneous musical expressions

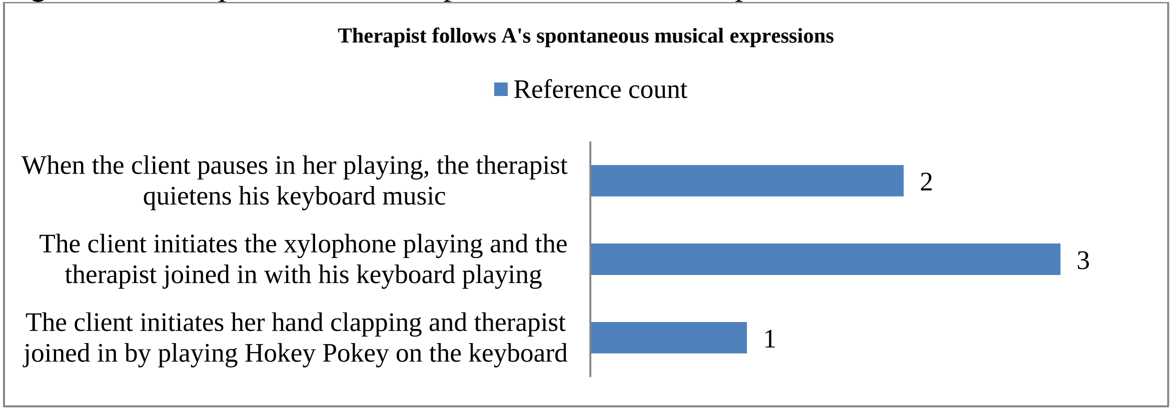


Figure 8.4 Therapist induces A’s engagement in music

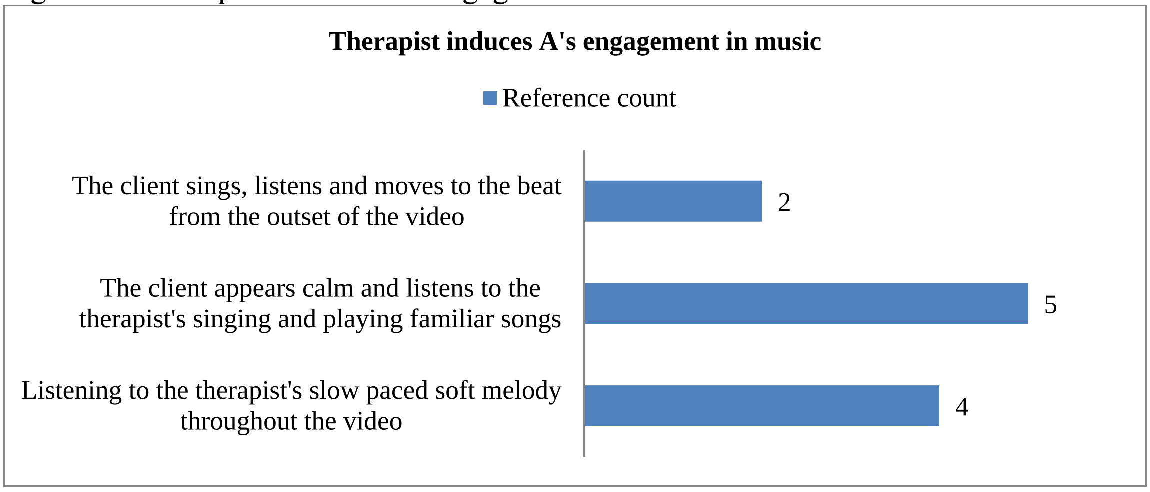



Figure 8.5 Therapist manipulates music to induce a change in A

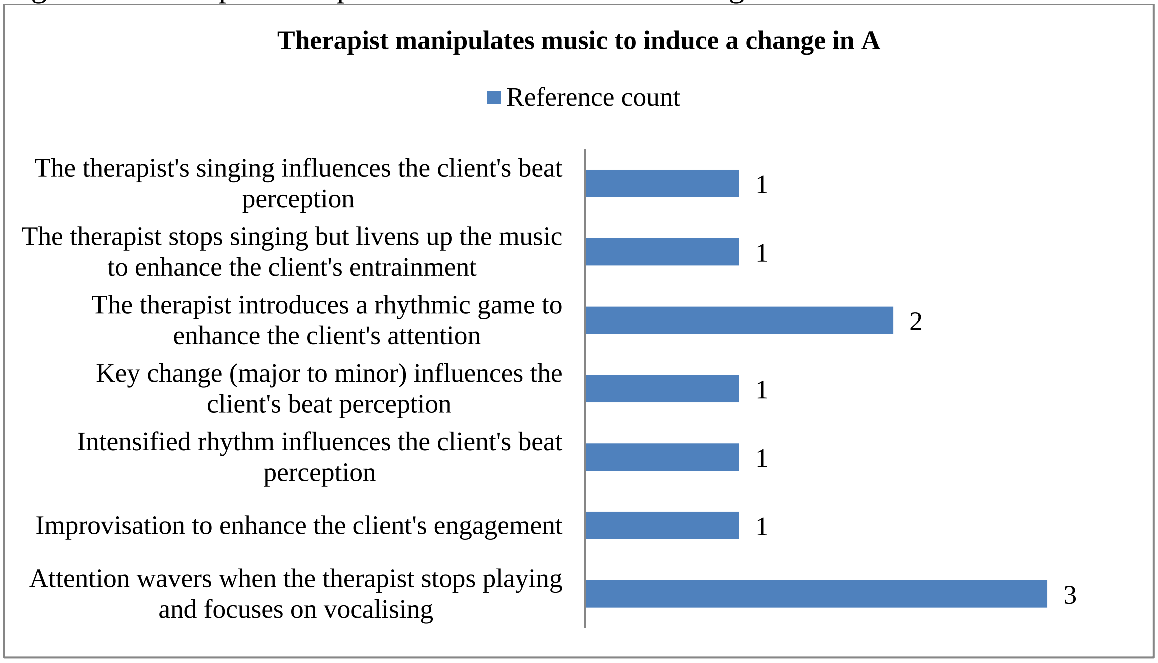



Figure 8.6, also produced using the matrix coding, presents the times when events occurred in client B’s videoed therapy sessions. As previously presented in section 6.3 and 7.2, B engaged mostly in verbal exchange during her therapy sessions. Therefore, no reference was made to times when the therapist followed the client’s expressions musically and when the therapist needed to manipulate the music to induce a change. Most references (36 references) were made to the times when B’s attention dwindled or symptoms emerged. This was followed by the times when the therapist needed to intervene after he finished the music (11 references). Three references were made to the

times when the therapist induced B’s engagement in music, which were coded as <The client recognises and sings Red Sails in the Sunset>.

Figure 8.6 Occurrence of events in B’s video excerpts (Cl: Client/Th: Therapist)

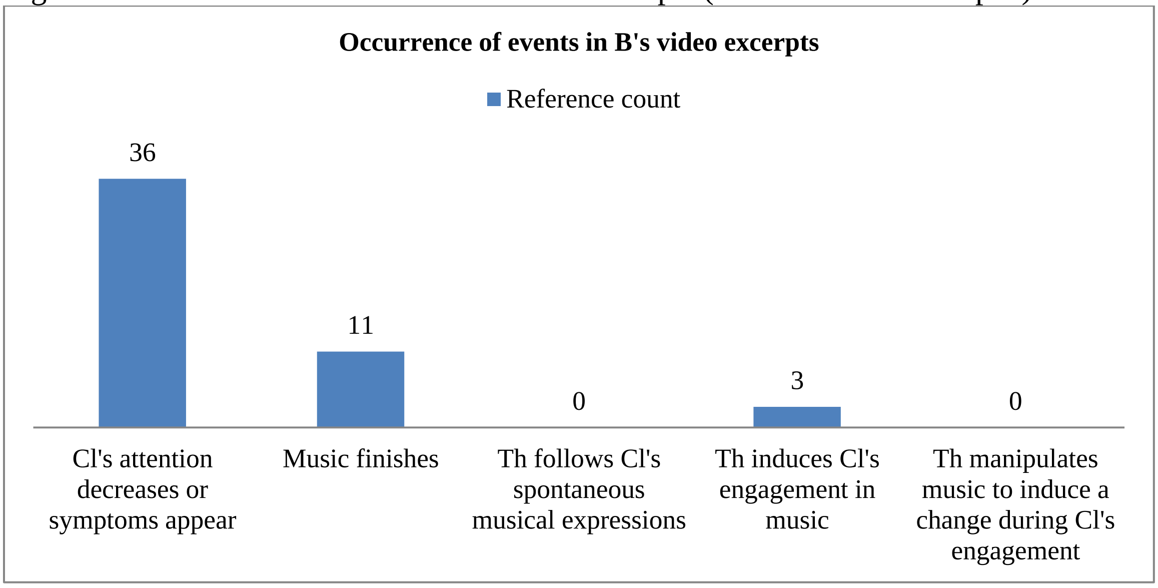



Figure 8.7 and 8.8 provide further details of the times when B’s attention decreased or symptoms appeared and when music finished.

Figure 8.7 B’s attention decreases and symptoms appear

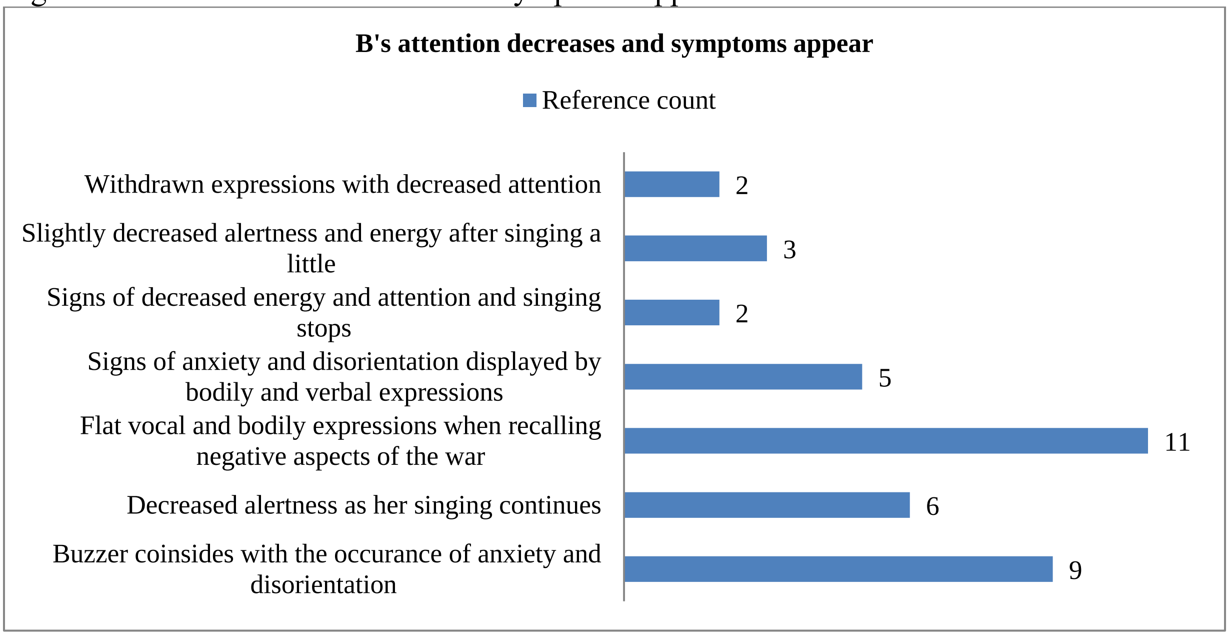
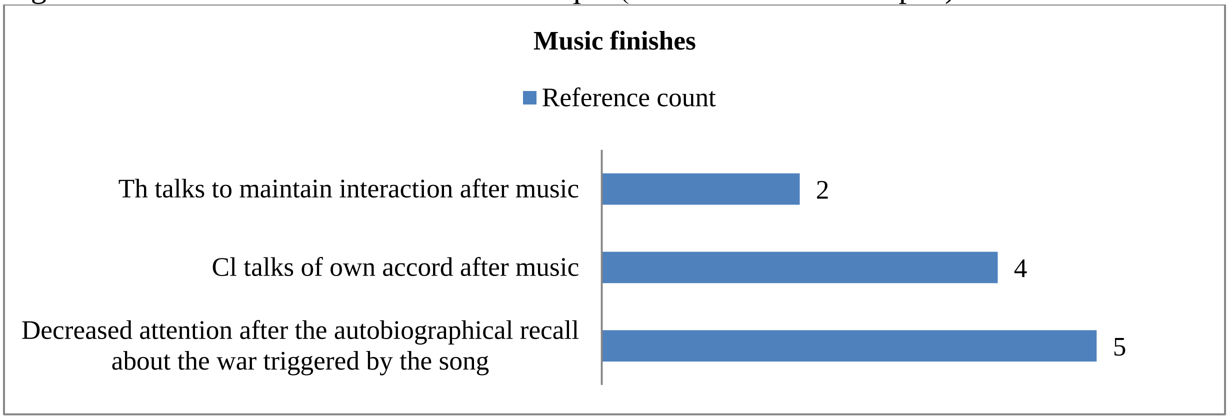


Figure 8.8 Music finishes in B's video excerpts (Cl: Client/ Th: Therapist)




## 8.3 Corporeal themes

Events in both clients' video excerpts were manifested by the actions of both the clients and the therapists. These actions were identified and coded as expressions. Table 8.2 presents the clients' 7 corporeal themes. Auditory expression consisted of 19 references, which included the clients' calm expression when they appeared to be listening to the therapist's verbal comments, singing and music playing. Most references (107 references) in Table 8.2 were made to facial expression. 8 references and 5 references were made to expresssions showing the occurrence and reduction of symptoms respectively.

Table 8.2 Seven corporeal themes of the clients

| Corporeal themes | Source | Reference |
|---|---|---|
| Facial expression | 27 | 107 |
| Musical expression | 19 | 102 |
| Bodily expression | 20 | 37 |
| Verbal expression | 14 | 30 |
| Auditory expression | 13 | 19 |
| Symptom occurrence | 7 | 8 |
| Symptom reduction | 4 | 5 |

### 8.3.1 A's corporeal themes

The matrix coding function produced Table 8.3, which presents the detailed coding under each of A's corporeal themes. Musical expression had the highest number of references (76 references) whilst verbal expression had the lowest number (2 references). The occurrence and reduction of symptom were all related to A's aberrant vocal noises.

Table 8.3 Coding of A's corporeal themes

| Auditory | Reference count |
|---|---|
| Listens to the therapist's improvised singing | 3 |
| Listens to the therapist's verbal comments | 1 |
| Listens to familiar songs | 8 |
| Bodily | Reference count |
| Adjusts posture or belongings | 2 |
| Applause | 3 |
| Cessation or reduction in movement | 5 |
| Head movements | 6 |
| Facial | Reference count |
| Eye contact or gaze towards therapist | 29 |
| Eye gaze towards instruments | 6 |
| Laughter | 3 |
| Smiles | 23 |
| Static eye gaze | 6 |
| Musical | Reference count |
| Habituation | 3 |
| Inability to keep time due to diverted attention whilst singing | 1 |
| Instrumental | 30 |
| Musical movement | 32 |
| Vocal | 10 |
| Symptom occurrence | Reference count |
| Aberrant vocal behaviour | 8 |
| Symptom reduction | Reference count |
| Reduced vocal noises | 1 |
| Vocal noises stop | 4 |
| Verbal | Reference count |
| Responses to the therapist and emphatic utterances | 1 |
| Talks to self | 1 |

Table 8.4 below presents A's specific musical expression codes, which had the highest number of references in A's expressions. Three of the codes, instrumental, musical movement and vocal, were broken down into sub-codes. For example, musical movement (34 references) included clapping and limb movement. This shows that A's

musical expression was mostly through clapping (19 references), instrumental entrainment (15 references) and limb movement (15 references).

Table 8.4 Coding of A's musical expression

| Musical expression | Reference count |
|---|---|
| **Habituation** | 3 |
| **Inability to keep time due to diverted attention whilst singing** | 1 |
| **Instrumental** | |
| Changed rhythmic perception | 4 |
| Entrainment | 15 |
| Increased energy | 3 |
| Pause before symptom re-occurrence | 1 |
| Plays | 7 |
| **Musical movement** | |
| Claps | 19 |
| Moves limbs | 15 |
| **Vocal** | |
| Coherent singing | 1 |
| Intermittent singing | 1 |
| Vocalisations related to music | 8 |

### 8.3.2 B's corporeal themes

Table 8.5 was also produced using the matrix coding function. It presents the codes under B's corporeal themes. Facial expression had the highest number of references (37 references), followed by verbal expression (28 references). As B engaged mostly in verbal exchange in her therapy session, Table 8.6 displays the sub-codes for her verbal expression including reminiscence, emphatic utterances and self-knowledge.

Table 8.5 Coding of B's corporeal themes

| Auditory | Reference count |
|---|---|
| Listens more to the accompaniment | 1 |
| Listens to familiar songs | 6 |
| **Bodily** | **Reference count** |
| Adjusts posture or belongings | 5 |
| Closed posture | 1 |
| Head movements | 10 |
| Increased proximity to therapist | 1 |
| Open posture | 4 |
| **Facial** | **Reference count** |
| Eye contact or gaze towards therapist | 10 |
| Head or eyes lift | 13 |
| Laughter | 1 |
| Smiles | 13 |
| **Musical** | **Reference count** |
| Vocal | 20 |
| **Verbal** | **Reference count** |
| Reminiscence | 16 |
| Emphatic utterances | 9 |
| Self-knowledge | 3 |

Table 8.6 Coding of B's verbal expression

| Verbal expression | Reference count |
|---|---|
| **Reminiscence** | |
| Husband's favourite song | 2 |
| Son's name | 1 |
| About her father | 2 |
| Achievement at school | 1 |
| Husband's return from war | 1 |
| Memories related to the song | 4 |
| The names of her sisters and children | 5 |
| **Emphatic utterances** | |
| During recall | 1 |
| Agrees with the therapist's remarks | 5 |
| Responds to the questions about the lyrics | 3 |
| **Self-knowledge** | |
| Preference for tea | 2 |
| Having known the lyrics for a long time | 1 |

### 8.3.3 Cognitive functions as part of A and B's corporeal themes

Whilst events in the clients' video excerpts were coded based on their expressions, the cognitive psychologist and music therapist also noted that the clients used a variety of cognitive functions in conjunction with these expressions. For example, the cognitive psychologist noted the following event:

> "When the therapist stops playing, the client stops keeping the time (of music). Then there is a 'game' of sounds and silences between the therapist and the client."

The psychologist linked this note to a description of cognitive functions, particularly attention:

> "[This indicates] sustained attention (the ability to maintain attention over time with an adequate level of response) and selective attention (the ability to maintain a cognitive set including both activation and inhibition of specific responses). The lady has to stay focused on the task to be able to perform the exercise correctly."

Based on the notes by the psychologist and music therapist, both clients' cognitive functions were coded into 5 identified themes: Attention, Sensorimotor, Mood, Memory and Language comprehension. The matrix coding function produced Figure 8.9 and 8.10 below, which present the observed cognitive functions that A and B accessed whilst displaying expressions of engagement in their video excerpts.

Figure 8.9 Observed cognitive functions in A’s video excerpts

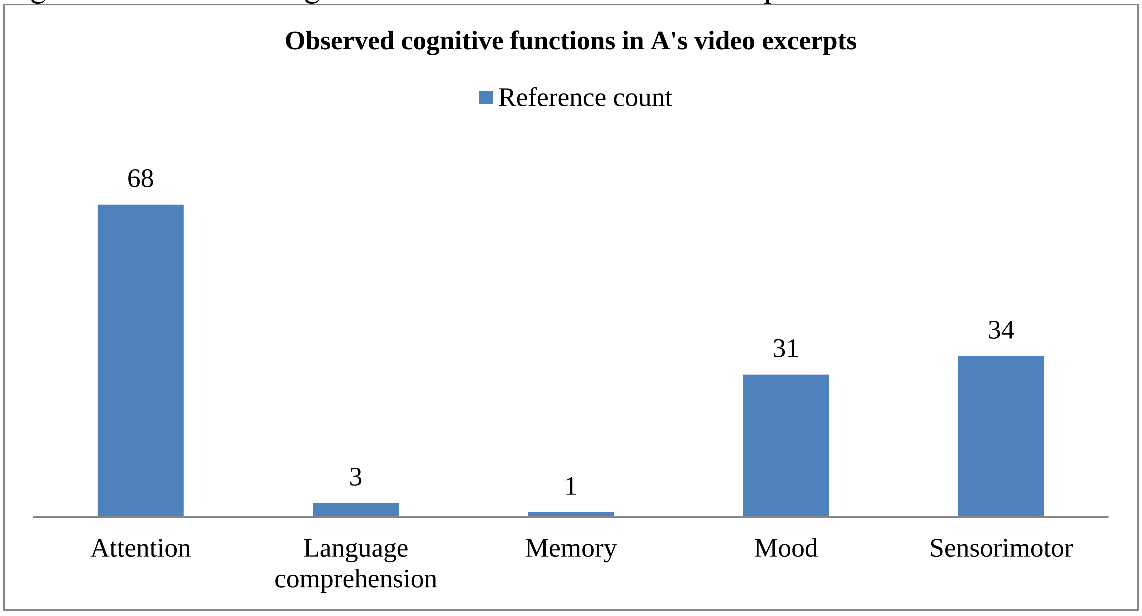
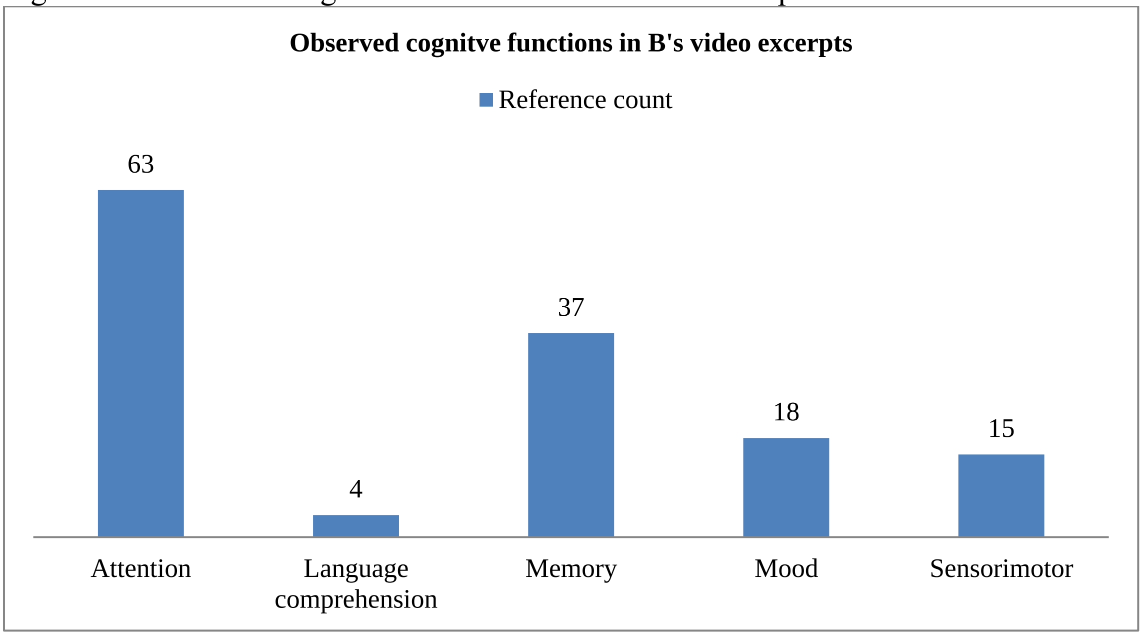



Figure 8.10 Observed cognitive functions in B’s video excerpts




#### 8.3.3.1 Attention

For both clients, attention appeared to be the most referenced cognitive function (68 for A and 63 for B) (Figure 8.9 and 8.10). Under the theme of attention, various types of attention were identified as sub-themes: sustained attention (88 references), selective attention (30 references), orienting response (14 references), alternating attention (1 reference) and habituation (3 references). Sustained attention appeared to be the most prominent type of attention, which also included alertness (22 references) and focused attention (12 references) (see Appendix 3 for break downs of coding).

**Alertness**

Noting aspects of alertness, the psychologist described A's expressions:

> "As soon as the song is finished, the client begins to talk about some of her memories associated with the song."

He then made a link between these expressions and the description of alertness:

> "Her tone becomes more expressive: when the lady speaks of her memories she maintains a reasonable level of alertness."

**Focused attention**

Focused attention is also a part of sustained attention. The psychologist wrote:

> "The lady starts to play in a more intense fashion and reverses back to playing all 3 beats (of the Waltz rhythm)."

This corresponded to the psychologist's description of focused attention:

> "Focused attention to the action while maintaining a good level of concentration on the action she is making."

**Selective attention**

Selective attention is a type of attention that denotes the ability to react selectively to a specific stimulus when several stimuli are occurring simultaneously. The psychologist noted:

"[When clapping], the client is still able to change the rhythm when the therapist does".

This note corresponded to:

> "Selective attention and the inhibition of irrelevant information."

Selective attention was often noted within the auditory modality. For example: the psychologist marked the description below as auditory selective attention:

> "When the therapist starts playing each accented note on the keyboard, the client starts to move her legs and the beaters in time".

**Orienting response**

Orienting response is a reflex response that occurs when someone attends to a change or a novel stimulus in their environment. In music therapy sessions, various stimuli were noted to have generated the clients' orienting responses. These stimuli included music, sound, verbal questions, objects in the surroundings and the therapist's movements, singing and vocalisations. The music therapist observed orienting response:

> "After M [therapist] starts singing to her, A seems a little more settled and stops making her aberrant vocal noise."

On a different occasion, the psychologist also noted A's orienting response to the sound made by the therapist:

> "At the inception of a new melodic variation made by the therapist, the lady stops vocalising and looks back at him."

**Alternating attention**

Alternating attention is one's ability to switch their attention back and forth between tasks. One observation regarding A's alternating attention was made by the cognitive psychologist:

> “The lady begins to keep time with the therapist’s keyboard playing and she alternates between playing the cymbal and the drum.”

The psychologist explained that this was “alternating attention (mental flexibility for switching from one task to another)”.

**Habituation**

3 references were made to the aspect of habituation, which is characterised by a decrease in attention to a stimulus after being repeatedly exposed to it. The music therapist wrote:

> “A continues to look into space and seems in a thoughtful mood, but her leg continues to move to the beat. Towards the end A’s attention seems to decrease a little and she becomes drowsy, possibly.”

The therapist then made an interpretation of the above note:

> “As A grows used to the music she seems to focus less on it, though shows some signs of continued engagement as evidenced by her musical movement in her leg.”
>
> “A’s attention seems to decrease further.”

#### 8.3.3.2 Sensorimotor and memory

Sensorimotor (Figure 8.9) for A and memory (Figure 8.10) for B were the second most referenced functions. Sensorimotor was referenced 34 times for A and memory was referenced 37 times for B.

Sensorimotor function included the sub-themes of intentional motor programming and feedback control (See Appendix 3 for further break downs of coding).

A’s intentional programming of movements was observed by the music therapist:

> “A seemed to be stimulated and motivated to musically engage herself.”
>
> “She looks at M [the therapist], smiles, and begins to tap her xylophone sticks together in time with the pulse.”

A’s coordination of movements was enabled through feedback control, which is the modification of ongoing movement using visual or auditory information. The psychologist noted:

> “[Whilst clapping] the client pays attention to what the therapist is doing and accordingly adapts her rhythm.”

He interpreted this as:

> “The lady understands, through the auditory feedback and the nonverbal communication made by the therapist, how to establish a dialogue made of sound and pauses,”

On another occasion, the psychologist observed that feedback control also enhanced A’s entrainment:

“When the therapist sings, the client seems to increase the intensity of her playing the cymbal.”

This observation was interpreted by the psychologist as:

> “The client seems to respond to inputs coming from the environment, increasing the intensity of the activity.”

For B, her memory function was coded into sub-themes including procedural, autobiographical, semantic recalls and recognition of songs. Semantic memory (6 references) involved B naming her family members (sisters and children) and accessing self knowledge, such as her preference of tea and knowing her and her husband’s favourite song. Procedural memory (13 references) was often observed when B was able to immediately sing with the melody and lyrics of the familiar songs. Autobiographical memory (16 references) regarding her husband's return from the war, her achievements in school and her family life with her sisters and parents was often evoked by the familiar songs:

> "B reminisces about first hearing the song being played on the radio. She talks to M [the therapist] with intermittent smiles, signs of alertness (eyes open, head lifted). She continues to reminisce about dancing on Saturday nights. She remembers other popular songs she enjoyed dancing and singing to."

#### 8.3.3.3 Mood

Mood is the third most referenced cognitive function in both A and B's video analysis. Under the theme of mood (Table 8.7), uplifted mood (30 references) and settled/calm mood (20 references) were identified as the two sub-themes. Uplifted mood appeared to be a result of using various cognitive functions, such as attention, memory and sensorimotor functions, when both clients were engaged in music listening, singing, and moving to the music. Settled and calm mood appeared to be a result of relaxation, reflection and reduction or absence of symptoms, which also involved both clients deploying their attention to music listening and memory recall. Table 8.7 presents these sub-themes and the number of references for each client (see Appendix 3 for further break downs of coding).

Table 8.7 Sub-themes of clients' moods

| Mood | Reference |
|---|---|
| **Settled & calm** | 20 |
| Absence of vocal noises (Attention to music listening) | 11 |
| Reduced anxiety (Attention to semantic recall) | 2 |
| Reflective (Attention to music listening) | 6 |
| Relaxation (Attention to a calming song) | 1 |
| **Uplifted** | 30 |
| **Attention** | 13 |
| Attention to change of musical accent | 1 |
| Attention to emotional verbal expression | 1 |
| Attention to gentle vocal tone | 1 |
| Attention to increased tempo | 1 |
| Attention to melodic improvisation | 1 |
| Attention to music listening | 7 |
| Attention to musical beat | 1 |
| **Memory** | 11 |
| Attention to positive verbal memory cues | 2 |
| Autobiographical recall | 2 |
| Evoked memories from songs | 4 |
| Semantic recall | 3 |
| **Sensorimotor** | 6 |
| Claps to the slowdown of the cadence | 2 |
| Instrument playing | 1 |
| Singing | 3 |

### 8.3.4 Association between cognitive functions and heart rate and heart rate variability

As each video excerpt was attached to a result of heart rate and heart rate variability (see Table 7.4), codes under the theme of cognitive functions were, therefore, labelled with these results. By using Nvivo 10's matrix coding function, Table 8.8 was produced to indicate how the clients' cognitive functions were associated with the parameters of heart rate and heart rate variability.

The blue highlights in Table 8.8 indicate the highest number of references made to each cognitive function. Attention is mostly associated with a high high-frequency power whilst memory is mostly associated with a low high-frequency power. Language comprehension is associated with a high standard deviation of heart rate whereas mood is associated with a low standard deviation of heart rate. Sensorimotor function is mostly associated a low RR interval and high heart rate.

Table 8.8 A and B’s cognitive functions and the associated indices of heart rate variability (Blue highlights indicate the highest number of references for each cognitive function)

| | Attention | Language comprehension | Memory | Mood | Sensorimotor |
|---|---|---|---|---|---|
| High high-frequency power | 56 | 0 | 7 | 8 | 3 |
| Low high-frequency power | 24 | 2 | 12 | 8 | 13 |
| High low-frequency /high-frequency ratio | 10 | 0 | 1 | 0 | 7 |
| High heart rate standard deviation | 15 | 5 | 3 | 6 | 6 |
| Low heart rate standard deviation | 2 | 0 | 0 | 17 | 0 |
| High RR interval standard deviation | 5 | 1 | 7 | 3 | 4 |
| Low RR interval standard deviation | 2 | 0 | 0 | 3 | 3 |
| Low heart rate | 2 | 0 | 0 | 9 | 1 |
| High RR interval & low heart rate | 0 | 0 | 5 | 2 | 1 |
| Low RR interval & high heart rate | 14 | 0 | 1 | 4 | 22 |
| Low standard deviation of heart rate and RR interval | 4 | 0 | 2 | 1 | 2 |
| High RR interval & low RR interval standard deviation | 12 | 0 | 0 | 4 | 4 |

### 8.3.5 Therapist's corporeal themes

Table 8.9 presents the therapist's 4 major corporeal themes. Musical expression (251 references) was the most referenced expression in A and B's video excerpts.

Table 8.9 Therapist's four corporeal themes

| Corporeal themes | Source | Reference |
|---|---|---|
| Musical expression | 24 | 238 |
| Facial expression | 26 | 100 |
| Verbal expression | 19 | 99 |
| Bodily expression | 22 | 66 |

The following section will present further coding within each of these expressions:

#### 8.3.5.1 Musical expression

Table 8.10 below presents the detailed coding of the therapist's musical expression, which was categorised into VOCAL and INSTRUMENTAL (see Appendix 4 for further break downs of coding).

Table 8.10 Coding of the therapist's musical expression

| Musical expression | Sources | References |
|---|---|---|
| VOCAL | 24 | 107 |
| Vocal harmony | 1 | 1 |
| Sustained notes | 2 | 3 |
| Sings | 17 | 55 |
| Matches client | 5 | 9 |
| Legato singing with a gentle timbre | 11 | 19 |
| Improvised singing | 6 | 19 |
| Acapella | 2 | 2 |
| INSTRUMENTAL | 23 | 131 |
| Waltz style | 3 | 3 |
| Timbre - staccato | 3 | 4 |
| Timbre - soft and legato | 10 | 12 |
| Rhythmic variation | 5 | 13 |
| Plays particular repertoire | 7 | 9 |
| Musical cues (pause, deceleration, modelling, intro) | 5 | 13 |
| Melodic improvisation | 4 | 7 |
| Matches client | 8 | 21 |
| Harmony or key | 2 | 4 |
| Gentle style | 4 | 8 |
| Accompaniment | 3 | 5 |
| Accents or emphasises | 12 | 33 |

The VOCAL category includes six methods, which were incorporated in the therapists' vocal expressions. The code "Sings" had the highest number of references. This code was broken down to ‘sings a particular song’ and ‘intermittent singing’. The cognitive psychologist noted that the therapist would choose a song that was familiar to the client:

> “The song played by the therapist allowed the stimulation of the memories associated with the song. The client seemed to benefit from retrieving information from her past experiences.”

The psychologist observed that when the therapist sang, he often sang intermittently, as he was using his singing as a prompt:

> “The therapist, seeing that the lady does not continue with the second verse of the song, begins to sing.”

The music therapist also noted that he sang to match the client and utilised a specific singing style and timber:

> “M [therapist] starts singing to echo A’s aberrant vocal noise.”

> “M’s music has a calm feel. He sings in a soft tone, in a legato (smooth) style and the song seems lyrical and flowing.”

In the INSTRUMENTAL category, twelve methods were coded to indicate how the therapist played the instruments. Accents or emphasises was the most referenced (33) method. For example, the psychologist noted:

> “For the entire video, the therapist plays music, trying to emphasise the beat.”

The music therapist also noted:

> “[The therapist] uses a steady and consistent beat which seems to provide an ‘anchor’ to be able to sing along to with ease.”

The therapist was also noted to musically match the clients. The psychologist made the observation:

> “The therapist tunes in with the lady’s rhythm, becoming part of reinforcement, a stimulus to help the lady maintain her active attention in order to continue the movements.”

On a different occasion, the music therapist noted:

> “Therapist makes continual adjustments to his music to fit in and attune to R, supporting her and maintaining musical cohesiveness.”

Various musical cues, such as pauses, deceleration, modelling and making an introduction, were employed by the therapist. For example, the therapist would slow down the tempo during the cadence to cue the ending of the music:

> “The therapist appears to "announce" the ending of the song by decelerating the speed of his playing and accompanying such deceleration with sweeping movements of his torso and hands.”

Timbre was another feature in the therapist’s music. The psychologist made some observations of this:

> “The therapist plays the song with a light timbre,”

> “The therapist is playing the song with arpeggios to soften the melody,”

#### 8.3.5.2 Facial expression

Table 8.11 presents the four types of facial expression used by the therapist.

Table 8.11 Coding of the therapist’s facial expression

| Facial expression | Sources | References |
|---|---|---|
| Eye contact & gaze directed at client | 23 | 51 |
| Laughter | 16 | 38 |
| Smiles | 13 | 25 |
| Facial expressions at the end of the song | 1 | 3 |

The therapist was frequently noted to direct his eye contact or gaze at the clients. The music therapist noted:

> “[The therapist] constantly looks over at A every few seconds to engage her and perhaps to monitor her level of engagement”.

Smiles and laughter were often incorporated into therapist facial expressions to engage the clients. The music therapist noted:

> “[The therapist] gives positive facial expressions (smiles); this seems to engage [B] and put her at her ease”.
>
> “Laughter from [the therapist] prompts further laughter from [B]”.

It was also noted that the therapist used his facial expressions to cue the cadence of a song. The music therapist noted:

> “At the end of the song [the therapist] increases his musical movements and facial expressions to engage A”.

#### 8.3.5.3 Bodily expression

Table 8.12 presents the three subthemes within the therapist’s bodily expressions.

Table 8.12 Coding of the therapist's bodily expression

| Bodily expressions | Sources | References |
|---|---|---|
| Musical movement | 15 | 48 |
| Increased proximity to client | 6 | 15 |
| Open, reassuring body language | 3 | 3 |

Most of the therapist's bodily expressions were noted as part of his musical expressions. The music therapist noted:

> "[The therapist] uses bodily expressions to emphasise the beat of the music".

On another occasion, the psychologist noted:

> "The therapist's body movements accompany the variation of the colour and melody of the song."

The music therapist noted the therapist's bodily expressions during a cadence:

> "[The therapist] slows down the music with expansive physical gestures".

The therapist was also noted to lean towards the clients to increase proximity whilst playing the music and speaking with the clients. The music therapist made the observations below:

> "He uses body language to lean into [B] and to move to the music, emphasising the beat."

> "[The therapist] echoes/reflects what [B] says in his verbal response while continuing to lean towards her."

Using an open posture to reassure the clients was also observed in the therapist's body language by the psychologist:

> "He tries to avoid sudden movements and uses reassuring gestures."

#### 8.3.5.4 Verbal expression

Table 8.13 below presents the ten sub-themes under the theme of the therapist's verbal expressions (see Appendix 5 for further break downs of coding).

Table 8.13 Coding of the therapist verbal expression

| Verbal expressions | Sources | References |
|---|---|---|
| Verbal cues to memory recall | 6 | 24 |
| Therapist's manner and tone | 9 | 18 |
| Validation and echoing | 7 | 15 |
| Discussion of music | 6 | 12 |
| Semantic facts | 2 | 8 |
| Reassurance | 2 | 7 |
| Celebration of client | 2 | 5 |
| Reframing | 1 | 4 |
| Using humour | 3 | 4 |
| Cognitive labelling | 2 | 2 |

The most referenced sub-theme was verbal cues to memory recall (24 references). The therapist was noted to utilise his knowledge of the client's personal history as verbal cues to help the client retrieve long-term memories. The psychologist noted:

> "During the conversation, the therapist asks question about the client's past. At times, the therapist tries to help the client retrieve the autobiographical memory by providing some information regarding the client's life events, of which the therapist is aware of."

The therapist would also help the client focus on the positive aspects of the memory to counter emergent symptoms, such as anxiety. This was noted by the music therapist:

> "[The therapist] helps [B] to focus away from her immediate anxiety, onto positive memories".

> "[The therapist] suggests it was a joy when her husband finally returned [from war] a second time."

The therapist's manner and tone were noted in the most sources (9 sources). The psychologist noted:

> "The therapist shows an empathetic manner, remaining serene, calm and approachable towards the client."

The therapist would also adjust his utterance and listen to the client's attentively. This noted by the music therapist:

> "[The therapist] listens to [B] and makes gentle, empathetic vocal sounds and comments."

The therapist also used some psychological techniques to offset the emergence of symptoms. These techniques included cognitive labelling, reframing and humour, which all relied on the client's remaining cognition. For example, when the meaningful song triggered some sadness associated with B's memory, the therapist would help reframe the meaning of B's memory by highlighting the positive aspects. This is noted by the music therapist:

> "[The therapist] talks of the songs and how they help to give people hope."

The therapist used the method of cognitive labelling of emotions to help B understand the significance of her emotions within the context of here and now. The music therapist noted:

> "[The therapist] seems to reflect/attune to what [B]'s emotions would have been."

Some semantic facts were also used by the therapist as a method of diversion when B became anxious and disoriented. For example, the therapist knew that B was still able to grasp the concept of time and this was noted by the music therapist.

"He helps to orientate her by giving the time."

When B was anxious about her family not being able to find her and did not know what to do, the therapist used the method below noted by the music therapist:

> "[The therapist] gently offers a verbal solution and also tries to re-direct [B]'s attention onto the prospect of a cup of tea."

## 8.4 Relational themes

Table 8.14 presents the three major relational themes and their sub-themes which detail the causal relationship between the therapist and the clients' corporeal themes (See Appendix 6 for further break downs of coding).

Table 8.14 Three relational themes and sub-themes

| Relational themes | Sources | References |
|---|---|---|
| Flexible use of music elements stimulates cognition and regulate emotions | 24 | 57 |
| Familiar repertoire - stimulates memory recall | 10 | 15 |
| Improvisation - stimulates, enhances attention, engagement | 5 | 12 |
| Gentle timbre - relaxation, symptom reduction | 7 | 10 |
| Accents - enhances attention, stimulates engagement, sensorimotor functioning | 5 | 8 |
| Upbeat, rhythmic - stimulates, engages attention | 5 | 6 |
| Musical engagement - symptom reduction, enhanced functioning | 3 | 3 |
| Synchronising with client's beat - reinforces attention and motor control | 2 | 2 |
| Musical timbre chosen to attune, support | 1 | 1 |
| Verbal and vocal expressions prompt memory recall and enhance mood | 12 | 26 |
| Verbal prompting - memory recall activated - enhances mood | 9 | 13 |
| Vocal tone, body language - enables interactive communication | 3 | 7 |
| Verbal validation, attunement - regulation of mood, anxiety levels | 2 | 4 |
| Verbal exchange - motivating, prompts engagement | 2 | 2 |
| Bodily and facial expressions complement musical and verbal cues to enhance attention and engagement | 5 | 13 |
| Vocal, bodily, facial expressions and eye contact enhance the client's focused attention, orientation, participation, engagement | 5 | 11 |
| Marked movements and slowed down tempo help the client to anticipate the end of the song | 1 | 1 |

| | | |
|---|---|---|
| Music and body movements are combined to provide an aid for sensorimotor integration | 1 | 1 |

### 8.4.1 Flexible use of music elements stimulates cognition and regulate emotions

Flexibly adjusting musical elements or parameters, such as vocal and instrumental timbre, pitch, accent and rhythm, was noted as one of the three major themes. These elements were used by the therapist in order to stimulate the clients' cognitive functions as well as reduce their symptoms. Under this theme, the repertoire of songs appeared to be the most referenced sub-theme (15 references) that was used to stimulate memory recall. For example, the music therapist noted:

> "Both procedural and autobiographical memories seemed to be accessed (procedural: singing the song lyrics; autobiographical: remembering the relevance/context/meaning of the song)".

Improvisation was another highly referenced sub-theme (12 references), which involved the therapist using vocalisations, singing, melodic and rhythmic variations, pitch and musical keys to enhance attention and engagement. For example, the psychologist noted:

> "The introduction of the high notes seems to stimulate the lady's auditory attention and enables her to respond with more precise movements."

> "The therapist's vocalisation seems to affect positively the lady who imitates the therapist and starts to vocalise. In addition, the vocalisation at regular intervals helps the lady anticipate the phrasing in the musical dialogue created between the two."

### 8.4.2 Verbal expressions prompt memory recall and enhance mood

The therapist was also noted to use his verbal expressions to validate the clients' emotions, help retrieve different types of memory and induce engagement in verbal exchange and, therefore, enhance mood (see Appendix 6 for detailed codes). Verbal prompts were the most referenced sub-themes (13 references) under this major theme. For instance, the psychologist observed that the therapist would direct the client's attention to semantic facts when a symptom, such as anxiety, appeared.

> "The therapist tries to calm and reassure the client, also using semantic topics."
>
> "Through the stimulated semantic memory, the therapist seeks to calm the lady. The conversations guide the lady in the context of reality."

The psychologist also noted that the therapist would use questions about the client's personal history to engage the client in autobiographical recall. This process appeared to modulate the client's emotions:

> "The questions asked by the therapist stimulate the client's sustained and selective attention as well as her autobiographical memory."
>
> "Moreover, this influences the client's emotion in a positive way…This does not only help the client remember but also stimulates the process of recalling information in memory."

### 8.4.3 Bodily and facial expressions complement musical and verbal cues to enhance attention and engagement

The therapist was observed to incorporate his bodily and facial expressions, such as smiling, making eye contact and leaning towards the clients, into his musical and verbal expressions. These expressions appeared to have an effect on the clients' attention, sensorimotor function and emotions. The psychologist noted:

> “The fact that the therapist continues to turn to the lady and makes eye contact with her allows the stimulation of cognitive components (such as attention and orientation) and the lady’s emotion involved in this process.”

> “With the combination of the music and body movements, the therapist seems to act as an "aid to help the client perform correct movements (e.g., clapping to the beat)".”

The music therapist also noted:

> “Using eye contact, smiles, musical movement and close proximity all seem to help to engage the client and sustain/regain the client’s attention, as well as facilitating the client’s active participation.”

# Chapter 9 Discussion and conclusions

## 9.1 Introduction

The intent of this study was to explore the feasibility of carrying out a 5-month music therapy programme in dementia residential homes. This was addressed through recruitment, retention, carers' perceptions of the intervention and the possible effects of the intervention on the residents' neuropsychiatric symptoms of dementia and wellbeing. Additionally, by involving both care home residents and their carers as participants, the study explored whether and how the intervention might bring changes to residents during weekly therapy sessions and to carers in day-to-day caregiving. The chapter will discuss the findings in line with the three research questions outlined in Chapter 3 and relate to the findings from previous studies. This discussion will be followed by a review of the research design, method and data analysis and the issues and limitations of the current study. Following this, the chapter will present some recommendations for clinical practice, and draw a final conclusion.

## 9.2 Main findings and relationships with previous research

### 9.2.1 Finding 1: The provision of weekly individual music therapy was feasible to residents and care staff in dementia care homes

The music therapy programme appeared to show overall acceptability and validity. No adverse effects were observed as a result of the trial. Although the completion rate in the intervention group was lower (67 %), this may be largely due to factors that were not related to the intervention itself, i.e. residents' ill-health and carer's personal reasons. The care staff participants were enthusiastic about the input of music therapy throughout the five months. They also displayed willingness and consistency in being involved in the interviews for Neuropsychiatric Inventory (NPI) and the observations for Dementia Care Mapping (DCM). The study suggests beneficial effects of a music therapy programme on the symptoms of dementia and occupational disruptiveness as measured by the NPI. In addition, the music therapy programme was also associated with higher levels of well-being, as measured and indicated by the DCM.

The findings of the current study concur with three earlier studies that used NPI as the outcome measure to indicate the ameliorating effects of music therapy on neuropsychiatric symptoms of dementia (Raglio et al., 2008; 2010; Vink et al., 2014). However, these three studies administered a 30 or 40 minute music therapy session at a higher frequency (biweekly and 3 times a week) and in a group setting rather than 1:1. Therefore, it is difficult to draw conclusive comparisons as the intervention in the current study was active individual music therapy administered once a week. Another study (Ridder et al., 2013) reported possible benefits of biweekly active individual music therapy over a 6 week period in managing agitation disruptiveness in dementia care. This is supported by the findings of the current study, which indicate that administering a lower dose of individual music therapy over a longer period could potentially generate similar effects.

Regarding benefits in caregiving (measured by DCM), despite the promising effects reported in the semi-structured interviews, no statistical significance was detected. This outcome might have resulted from the limited number of observations (2-hour observations using DCM were carried out at each of the 4 time points during the study). In future studies, more observations should be carried out. Pairing up carers and residents for observation should also be implemented in order to closely monitor changes in carers' interaction with residents. Despite this shortcoming, the data from the semi-structured interviews suggested further acceptability and clinical utility of the music therapy programme.

### 9.2.2 Finding 2: Therapist-carer communication using video presentation enhanced caregiving, which sustained an effect on neuropsychiatric symptoms over time

This feasibility study employed a music therapy intervention that emphasised post session video presentations to carers in addition to weekly music therapy sessions to care home residents with dementia. The qualitative data revealed that the video presentations allowed the care staff to witness an array of music therapist-resident interactions during the sessions. These interactions appeared to be surprising and uplifting to the staff, and demonstrated how residents' symptoms were reduced and how their remaining cognitive functions were activated. As a result, staff were motivated to utilise the learned insights and ideas from the video presentations in symptom management. This may explain the quantitative results as measured by the Neuropsychiatric Inventory (NPI), which indicated a continuing effect of individual music therapy on residents' symptoms after the intervention period was finished.

During the trial, carers were able to regularly report what they had observed and accomplished in their interactions with the residents during their day-to-day care practice. This corresponds to the findings of Lawrence et al. (2012) that providing staff with practice opportunities and embedding psychosocial interventions into daily care are necessary for successful implementation of such interventions. Moreover, this supports the use of videos as an effective teaching method for staff training (Kuske et al., 2007). The weekly presentation and communication also functioned to be an ongoing support to enhance staff interaction skills and increase their awareness of causes of symptoms. Therefore, a change in staff behaviour could be induced and sustained over time as noted by Aylward et al. (2003), Kuske et al. (2007) and Spector, Orrell and Goyder (2013).

These results suggest an educational role of the music therapist in enhancing the multidisciplinary care planning and delivery. This educational role may also be the key to enabling music therapy to contribute to the context of care, where staff strategies and character are pivotal in long-term symptom management (de Vugt et al., 2004; Sink et al., 2006). The non-RCT study (n=9) by Schall, Haberstroh and Pantel (2014) found significant effects on communication behaviour, situational wellbeing and positive emotions during individual music therapy sessions. The study used a time series analysis, measuring these 3 aspects every 30 seconds of the 27 videoed individual music therapy sessions. Despite the positive outcomes found in the sessions, the pre/post NPI assessments did not show a significant change over the 6 month period of weekly intervention. This indicated that individual music therapy did not have a long term effect on neuropsychiatric symptoms, but suggested temporary benefits that only existed within the sessions. This might be due to the study not relating music therapy to the context of care. In a three armed randomised controlled trial study (n= 120), Raglio et al. (2015) compared standard care with biweekly individual music therapy sessions in addition to standard care and individualised music listening in addition to standard care over 10 weeks. The study found significant improvement in symptoms and quality of life in all three groups. This suggests no additional benefits of individual music therapy. The follow-up assessment (two months after the intervention stopped) only found continuing effects on specific symptoms, which included delusion, anxiety and disinhibition. Interestingly, the authors discussed that the results might have been influenced by the variable approaches in care management across the 9 participating institutions. Different approaches in care management might have reduced the effects of the treatments. However, the authors did not indicate any post therapy communication as part of their music therapy intervention. Therefore, it was unclear regarding how and to what extent their music therapy intervention was affected by the styles of care management or vice versa. Once again, the findings of the current study suggest that post-therapy communication with care staff is an essential part of the intervention and support the growing interest in music therapist-care staff collaboration (Melhuish, Beuzeboc and Guzmán, 2015; Ray et al., 2016). Music therapy in care homes may need to be provided with a view to enhance caregiving to enable a possible long term impact on residents' neuropsychiatric symptoms.

### 9.2.3 Finding 3: Individualised engagement in musical, verbal and nonverbal expressions within therapist-client interaction in music therapy, modulated emotional arousal, as indicated by the change of heart rate and heart rate variability

Chapter 5, 6, 7 and 8 presented two contrasting case studies; client A, who displayed symptomatic aberrant vocal noises, spent most time in her sessions on entraining to the therapist's music (Figure 7.1) and client B, who displayed symptomatic and emergent anxiety, engaged mostly in talking and reminiscing during therapy (Figure 7.2). The case studies employed the measurements of the two clients' heat rate (HR) and heart rate variability (HRV) to examine their musical, verbal and nonverbal expressions in the therapy sessions. A's HR appeared to be the highest and most changeable during her engagement in entraining movements or singing in between these movements (Figure 7.7 and 7.9). This high HR and its high changeability might be most likely attributable to the increased motor activity during A's entraining movements. In B's case, reminiscing and talking generated the highest HR whilst generally talking with the therapist generated the most changeable HR (Figure 7.8 and 7.10). This might be supported by the research finding that HR acceleration is linked to the processing of stored information (Jennings and Hall, 1980).

The two case studies in the current study add to the previous findings by Ridder (2003) and Ridder and Aldridge (2005) by indicating the regulation of emotional arousal during individual music therapy as manifested by the change of heart rate. However, the current study further investigated the change of the indices of heart rate variability (HRV) in the two clients' different types of engagement in the therapy sessions. The results of the clients' HRV shows that A had a largest mean RR interval during her engagement in a series of activities; changing from improvising on the instruments to receptive listening, singing, entrainment, and improvising again and finally to singing (see Table 7.3 and Figure 7.3). Interestingly, when A engaged solely in receptive music listening, the second largest mean RR interval was displayed. On the contrary, B had the largest mean RR interval during her engagement in talking and reminiscing whilst showing signs of anxiety (Table 7.3 and Figure 7.4). However, B's second largest mean RR interval was found when she engaged in singing (Figure 7.4). RR interval is an index of HRV. Longer duration of RR interval indicates higher level of heart rate variability, which has been suggested to be associated with cognitive, affective, behavioural and physiological regulation (Thayer and Lane, 2000; Appelhans and Luecken, 2006; Thayer et al, 2009). This suggests that A and B might have obtained beneficial effects from different types of engagement.

In addition to RR interval, the current study examined the clients' relative High Frequency power (relative HF power), which is another index of HRV. Similarly with the results of mean RR interval, A's highest mean relative HF power was found in the times when she was engaged in listening to the therapist's music and was subsequently motivated to move to the music (Figure 7.11). B's highest mean relative HF power was found, again, when she was engaged in singing (Figure 7.12). This suggests that music still played a key role in the both clients' engagements as indicated by the high mean HF powers. In addition, B's engagements in reminiscence presented the second highest mean Relative HF (Figure 7.12). This indicates that although music was important, it was not the only beneficial element in music therapy. Verbal exchange, especially engaging clients in retrieving long term memory, could also be a major therapeutic element. Relative HF power is primarily mediated by the parasympathetic branch (e.g. resting and restoring) of the autonomic nervous system, which receives influence from the vagus nerve. The vagus nerve is believed to be the connection between the heart and several brain regions within the central nervous system, such as the amygdala, ventromedial prefrontal cortex, orbitofrontal cortex and the righ dorsolateral prefrontal cortex (Lane et al., 2009; Nugent et al., 2011; Thayer et al., 2012). Activity in these brain areas is linked to the perception of safety and threat (Thayer et al., 2012) and emotional appraisal, generation and response (Phan and Sripada, 2013, p. 381). Once again, this stresses the underlying physiological and cognitive mechanism of engagement in musical, bodily, verbal and vocal expressions. This may be dependent on each individual client's personal preference and levels of functioning. For example, A displayed limited speech production and was not able to sing with words. However, she was able to engage well by using her movements, such as hand clapping and foot tapping, when listening to the therapist's music. B was able to sing with words but she did not engage in using movements and chose not to play any instruments. Therefore, the use of music would need to be considered in line with individual differences. This finding may support the feasibility of individual music therapy in care homes in Finding 1 and suggest individual music therapy as a preferable intervention for this client group over group music therapy, which uses a "one size fits all" approach.

In addition to examining the clients' HR and HRV during the sessions, the current study also attempted to investigate the clients' 5-minute resting HRV before and after the therapy sessions. The clients' pre- and post- therapy resting HRV were measured as an outcome of interest in an attempt to indicate the effect of individual music therapy. Several parameters of HRV were used for this purpose.  The parameters included RMSSD (square root of the mean squared differences between successive RR intervals), pNN50 (NN50 divided by the total number of RR intervals) and absolute HF power (the number of beat-to-beat intervals matching the High Frequency band from 0.15 to 0.4 Hz, which is estimated in milliseconds squared) (see section 3.6.5 in Chapter 3). However, due to insufficient data collected for the current study, only descriptive analysis was performed using the data collected from the four sessions of each of the two clients (detailed in chapter 7). No increase in RMSSD, pNN50 and absolute HF power was found after all A's 4 sessions whilst some increases were found after some of B's 4 sessions. As no inferential statistical analysis was performed, there is no comparison with the previous studies by Okada et al. (2009) and Raglio et al. (2010) which found significant increases in these parameters of HRV.

Whilst further studies with sufficient data are needed to add to the findings of the previous studies, the collection of HR and HRV was proved to be challenging in the current study. This was due to the difficulties in attaching the heart rate monitor to clients with advanced dementia, who were unable to comprehend the use of the device and could find the monitor, which is worn around the chest, to be intrusive. Moreover, collecting resting HR and HRV data required the clients to remain calm and stationary in a chair. This was proved difficult as the clients were not able to retain this information due to severe cognitive impairment. On one occasion, 3-minute instead of 5-minute pre- and post-therapy HRV data was used for B as she appeared to be unsettled in mood and unable to remain seated throughout the time of data collection. Future studies would benefit from more advanced technology, such as devices that can be attached without causing discomfort or requiring the participant to understand the data collection process.

### 9.2.4 Finding 4: Emotion regulation in music therapy involved the clients using their residual functions, such as attentional and affective processes, memory and sensorimotor skills to offset emergent symptoms

In order to triangulate with the quantitative results of HR and HRV, which suggested the modulation of emotional arousal, the case study employed a qualitative video analysis based on the framework of hermeneutic phenomenological analysis (van Manen, 1990). This framework helped explore the meaning of certain phenomena in the music therapy sessions as lived experience for the two care home residents with dementia. Ideally, the lived experience would have been explored through the two clients' personal narratives. However, due to the clients' reduced cognitive abilities, the lived experience was instead addressed through the observations of a cognitive psychologist and a music therapist, who is also a psychologist. The advantage of this was that both health professionals had worked closely with patients in this particular clinical field and understood the patients' psychological and physiological needs. As a result, they were able to produce written text of their visual observations using a precise language within a neuropsychological paradigm. The analysis of the written text was then analysed by the author of the current study, who was the music therapist for the two clients in the study and understood the domains of cognition.

The results of the qualitative video analysis (outlined in Chapter 8) indicated that the music therapist engaged the clients in using their corporeal expressions, which were musical, verbal, vocal, bodily and facial. The results of the analysis further showed that when a client was expressing herself musically, verbally and nonverbally, she was using an array of residual functions simultaneously. Five residual functions, including attention, memory, mood, language comprehension and sensorimotor skills, were identified from the video analysis (Figure 8.9 and 8.10 in Chapter 8). These five functions were also found to be associated with different manifestations of HR and HRV (Table 8.8), which will be discussed as follows:

Sensorimotor skills were mostly associated with the high heart rate and low RR interval. This may be explained by the increased motor activity required when the clients actively engaged in singing, playing the instruments or moving to the beat.

Language comprehension was associated with high HR standard deviation. This means that the clients’ heart rates were most changeable during verbal interaction with the therapist in therapy. This might be reflected by the fact the client B spent most time on general conversations and reminiscence during her sessions. Often, general chatting and reminiscence coincided with the times when she was anxious and disorientated. This means that using verbal cues was the therapist’s major strategy to enable B to access her remaining cognitive functions and to modulate her emotions in therapy. The changeable HR may indicate a process of affective and physiological regulation. However, there is a lack of previous evidence to support this physiological phenomenon during language processing as observed in the current study. A study of cognitive behavioural therapy (CBT) for patients with depression (Carney et al., 2000) suggested that the therapy may reduce heart rate and increase short-term HRV for patients with depression. Another study of CBT for patients with panic disorder (Garakanki et al., 2009) also found similar HR and HRV results. The findings of these studies again suggest the therapeutic effects of verbal interaction, which requires patients to access their cognition. However, further research is warranted to examine how patients with dementia engaged in language processing during therapy and how their physiological parameters change during and after the engagement in language processing. Examining the content of verbal engagements may also be an area of interest for research in order to indicate how verbal interaction works by accessing the remaining domains of cognition (e.g., different types of memory recall) of patients with dementia.

Memory was observed in the video analysis of the current study and mostly associated with lower HF power. In B's case, the therapist often needed to help B retrieve autobiographical and semantic memory during her therapy sessions. The therapist also needed to direct B's attention to the positive aspects of B's life events in order to dissipate the sadness and nostalgia also brought by recalling these life events. The low HF power found in the current study may be supported with the findings by Marci et al. (2007), which suggested increased sympathetic activity with reciprocal decreased parasympathetic activity may be necessary to generate frontal activity in autobiographical recall of emotions (pp. 247-248). Moreover, Lane et al. (2009) found that autobiographical scripts which generated emotions, such as happiness and sadness, were associated with lower HF power than the scripts that generated a neutral emotion. However, it is important to note that healthy adults, rather than patients with dementia, were recruited as the participants in these two studies. Therefore, the result from the video analysis in the current study was simply reporting the physiological indicators associated with certain phenomena observed in the two clients' music therapy sessions. This result will merit from further investigation in testing if memory recall could reduce HF power in the population of dementia.

For both clients in the current study, the video analysis indicated that attention, particularly sustained attention, was the most prominent aspect of cognition observed in the video excerpts (see section 8.3.3.1 Attention in Chapter 8). This may be reflected by the fact that engagements in the therapy sessions would firstly require the clients to deploy their attention to undertaking actions, such as music playing and listening, singing and memory recall. Therefore, the therapist would need to select various visual and auditory stimuli, such as his music playing, singing, verbalisation or body movements to catch the clients' attention. As soon as the clients' attention had been activated, the therapist then needed to manipulate these stimuli in order to sustain the clients' attention in these musical, verbal and nonverbal actions. As mentioned earlier in section 2.7.2 in Chapter 2, attention is one of the most important constructs in emotional appraisal. Directing attention towards or away from emotionally provocative stimuli could reduce emotional impact (Phan and Sripada, 2013).

In the current study, using various stimuli provided by the therapist to modulate the clients' emotion may be supported by the findings by Goodkind et al. (2010).The authors suggested that despite impaired emotional functioning, people with mild to moderate Alzheimer's type of dementia could still spontaneously regulate their emotional responses through top-down processes. Top-down processes describe knowledge-driven mechanisms, such as the ability to filter unwanted information, attend to the location of target stimulus, identify the attributes of attended sensory stimulus and respond accordingly with previously acquired response rules (Kastner and Ungerleider, 2000; Sarter, Givens and Bruno, 2001). Furthermore, the video analysis in the current study also found that the clients' attentional processes were mostly associated with high frequency HRV (Table 8.8). This result appears to conflict with the general idea that increased mental effort, which involves attention and working memory, activates sympathetic nervous system and hence increased HR and suppressed HRV (Porges and Raskin, 1969; Hjortskov et al., 2004; Taelman et al., 2011; Mateo et al., 2012).

It is worth noting that the finding in the current study is not to be generalised due to some issues concerning the research methods and purpose. Firstly, the current study employed an ambulatory approach to monitor how the clients responded to live stimuli provided during the therapist-client interaction in a real life situation. The stimuli could be anything the clients could see and hear during a session in the therapy room, such as the instruments or objects in sight, the therapist's speaking or singing voices, music, etc. These stimuli could also be presented to the clients simultaneously in different durations. This research method differs from studies using controlled presentation of single stimulus in a laboratory. In laboratory setting, the stimuli can be presented with the same duration and any other interfering visual and auditory stimuli can be excluded. Secondly, the association between attention and HF power in the current study was found through a psychologist and music therapist's subjective observations of video excerpts, that had previously been labelled with various parameters of HRV. This means that the two observers had observed more attention processes used by the clients in the video excerpts labelled with the clients' HF powers. However, this result was influenced by how many times the two observers used the word 'attention' in their written observations. Therefore, the observed HF power in the current study is an observed physiological phenomenon, which may pertain to a hypothesis. It should not be interpreted in comparison with the quantitative results of previous research. Further rigorous experimental testing is required to determine whether HRV can be increased by clients' attentional processes utilised in therapist-client interaction in music therapy.

The video analysis shows that mood change was a significant aspect in the music therapy sessions, considering the attentional, affective and sensorimotor processes required to enable the clients to engage in the interaction with the therapist (Table 8.7). Two types of mood, which included settled & calm mood and uplifted mood, were identified from the video analysis. Settled & calm mood was linked to the reduction of symptoms which occurred through the clients attending to semantic recall or music listening. Uplifted mood was manifested by the clients whose attention was directed to various music elements, the therapist' expressions, memory recall, instrument playing, singing or moving to the music. As mood is a major factor impacting on care home residents' quality of life (Hoe et al. 2006), the phenomenon of emotion regulation, which utilises residents' remaining functioning, may be a key to reducing symptoms in music therapy and may be utilised outside therapy in day-to-day life.

Furthermore, mood was also found to be mostly associated with low HR standard deviation. This may suggest that the clients' heart rates were stabilised as result of the vagal influence during the times when they displayed social connectedness and a positive mood in music therapy. This phenomenon may be supported by Polyvagal theory (Porges, 2001) and other research findings (Kok et al., 2010; 2013), which suggest the relationship between positive emotions, social engagement and vagal tone. However, this phenomenon's occurrence in the current study was subject to the number of times the observers of the low HR deviation video excerpts wrote down the descriptions of the clients' mood. Therefore, stabilised heart rate as a result of positive social engagement in music therapy for patients with dementia would remain as a hypothesis, which warrants further scientific investigations.

All in all, finding 4 suggests that utilising dementia care home residents' remaining cognitive and sensorimotor abilities enables emotion regulation to reduce neuropsychiatric symptoms. Among the five remaining abilities found, attention appeared to be the gateway to engagements in the musical, verbal and nonverbal interaction between the clients and therapist. These engagements then allowed emotion regulation to take place. In addition, this finding stresses that in order to utilise residents' residual functions, the therapist would need to identify what functions remain accessible to individual residents and what stimuli could be used to catch residents' attention to actively engage them.

#### 9.2.5 Finding 5: Emotion regulation relied on the music therapist's responding in a timely manner. This included the music therapist strategically and flexibly using his own expressions, appropriate music therapy techniques and his understanding of the clients' history and functioning.

In addition to the clients' corporeal expressions and the associated cognitive functions, the current study also examined the therapist's expressions through the video analysis.

How the therapist used his expressions as sensory stimuli for the clients played a crucial role within the therapist-client interaction. The modulation of the clients' mood and behaviours appeared to rely on what stimuli the therapist provided. The therapist could manipulate these stimuli to capture the clients' attention and sustain engagement throughout the sessions. The results of the video analysis confirmed the content of the music therapy intervention in the feasibility study (Section 3.5.3 in Chapter 3): the therapist's musical, verbal, facial and bodily expressions were the major stimuli provided within the individual music therapy sessions (see Table 8.9). These were used in accordance with the level of functioning of the clients. The therapist used more of his musical expressions to engage client A, as A displayed reduced speech production but a remaining ability to entrain to the music. In contrast, he used more verbal expressions to engage client B, as she was able to communicate well verbally and access remote memories. Moreover, this suggests that the therapist's expressions served as sensory inputs to induce the clients' expressions as action outputs. As presented in Table 8.14, these sensory inputs, such as music elements, verbal prompts, vocal, facial and bodily expressions were all used strategically and flexibly in order to achieve various goals in therapy.

Unsurprisingly, music stood out as the most prominent feature in the music therapy sessions. However, music was used as an umbrella term, which broadly covered different methods of utilising music and music elements in order to provide cognitive stimulation and reduce symptoms. Among the methods identified from the video analysis, using a familiar repertoire was most referenced in the sessions for promoting memory recall. This was particularly noted in B's case. Excerpt 15 (A meaningful song to promote reminiscence) detailed in section 6.3.9 provided an example of B singing her favourite song, 'Red Sails in the Sunset', which prompted her autobiographical recall of the life events associated with the song. Familiar or well-known songs in music therapy have been widely employed in numerous studies (Prickett and Moore, 1991; Clair, 1996; Ashida, 2000; Ridder, 2003; 2005; 2013; Lesta and Petocz, 2006; Svandottir and Snaedal, 2006; Takahashi and Matsushita, 2006; Tomaino, 2013; Dassa and Amir, 2014; Ray and Mittleman, 2015; Ray et al., 2016). Familiarity with music has been found to activate a broad network of brain regions, which include the emotion related limbic and paralimbic regions, reward circuitry, cingulate cortex, motor cortex, frontal lobe and Broca’s area. It is a major factor in why listeners emotionally engage with music (Pereira et al., 2011). The use of familiar songs or music in music therapy is further supported by the growing evidence of spared musical memory to learn a new song or recall and recognise lyrics and melody in patients with semantic dementia and Alzheimer’s disease (AD) (Schwarts, Marin and Saffran, 1979; Cowles et al. 2003; Cuddy and Duffin 2005; Hailstone et al. 2009; Hsieh et al., 2011; Cuddy, Duffin and Gill, 2012). Simmons-Stern, Budson and Ally (2010) found that patients with AD showed better recognition accuracy for the sung lyrics than the spoken lyrics. They also suggested that heightened arousal and spared brain regions sub-serving music processing might be the reason for more holistic encoding, improved memory as well as better recognition and attention. To support this notion, Jacobsen et al. (2015) identified that the anterior cingulate and ventral pre-supplementary motor areas were the key brain areas implicated in musical memory and were less affected than other areas in patients with AD. Therefore, this highlights a major potential therapeutic approach; employing familiar songs and music in music therapy for people with dementia. This approach may enhance social engagement and communication through the evocation of musical and autobiographical memory as well as the associated emotions as patients may retain the functioning of these cognitive domains (Cuddy, Sikka and Vanstone, 2015).

Furthermore, the use of a gentle timbre in the therapist’s singing voice was noted in the results of the video analysis to facilitate relaxation, symptom reduction and sensorimotor integration. As previously discussed in section 2.6.4, timbre, alongside intensity and pitch, is one of the acoustic properties of nonverbal vocalisations conveying affective information (Sauter et al., 2010). Brain regions, such as the amygdala and anterior insula, have been implicated in processing vocal emotion (Belin, Fecteau and Bedard, 2004). However, whether gentle timbre can be used to alleviate neuropsychiatric symptoms of dementia would warrant further more controlled experimental investigation, which might provide certain insight into the mechanisms of using vocal timbre to modulate emotions.

In addition to the therapist employing a familiar repertoire and adjusting his timbre of singing voice, improvisation was noted as another significant feature in the music therapy sessions (Table 8.14). Improvisation was more frequently used in client A's sessions in order to stimulate, enhance attention and engagement. The improvisation in the current study predominantly referred to the therapist's solo improvisation on an instrument and/or improvised singing or vocalisations whilst the client was listening and responding to the therapist. As previously presented in section 5.3.5, video excerpt 3 (Call and Response) was an example of this improvisation: the therapist improvised a short rhythmic pattern on the keyboard and paused immediately after the rhythmic pattern to allow A to respond with her clapping back the same rhythm. During the excerpt, A's heightened arousal and attention was indicated by her raised HR and HR standard deviation. It is important to note that this improvisation of call and response was a section derived from the song 'Little Brown Jug', which the therapist had been playing during video excerpt 3. Therefore, the improvisation was akin to a musical variation of 'Little Brown Jug'. This type of improvisation, based on the motif of a familiar song, was often used in A's sessions and contained certain degree of repetition. The use of repetition in the improvisation may be supported by the notion that human possess the ability to detect musical patterns and regularities (Koelsch and Friederici, 2003; Knösche et al., 2005; Neuhaus, Knösche and Friederici, 2009; Neuhaus, 2013). Thus, stimulating clients' structured music listening by using repetitive musical patterns may trigger and sustain the clients' auditory attention and generate the feeling of reward and pleasure.

Furthermore, improvisation provides an opportunity to flexibly use music elements. In the current study, this was manifested by the therapist's manipulation of tempo, vocal and instrumental timbre, key and pitch as described in the description of 16 selected video excerpts in Chapter 5 and 6 as well as outlined in the results of the video analysis (Table 8.14). This flexible use of music elements pertains to the violation of musical expectancies. Salimpoor et al. (2015) suggest that violation of musical expectancies activates brain regions, such as the inferior frontal regions, caudate and amygdala, which are implicated in processing structural aspects of music, anticipation and emotion, respectively. Violations of expectancies are directly linked with emotion (p.87). Therefore, flexibly switching between improvisation and familiar songs as well as using accent and gentle timbre (outlined in Table 8.14), may play a key role in modulating patients' emotions and mood in music therapy. Above all, this suggests that music elements, when flexibly used, may bypass the requirement of intact cognitive abilities to allow patients with dementia to perceive target emotion during therapist-client communication. The study by Bogert et al., (2016) may underpin this notion as the authors of the study propose that implicit (unintentional) neural processing of musical emotions is similar to reflexes and is sub-cortically generated without requiring awareness.

In contrast to musical expressions, the therapist's verbal expressions may regulate the clients' emotions by using the clients' explicit (intentional) neural processing of emotions via verbal content. Several psychological techniques used in cognitive therapy, such as reframing, labelling and humour, were identified in the therapist's use of his verbalisation (Section 8.3.5.4 Verbal expression and Table 8.13). These were observed particularly in client B's video excerpts, such as excerpt 11 (Semantic and positive autobiographical memory in enhancing positive emotions), 12 (Semantic form of self-knowledge in de-escalating emergent anxiety) and 16 (Attention deployed to positive aspects of remote memory to prevent emergent symptoms), which are detailed in Chapter 6. All of these techniques required client B to comprehend the therapist's verbal questions regarding her personal history and preferences and subsequently deployed her attention to retrieving the relevant autobiographical memory and semantic knowledge. As a result, B's symptomatic and emergent anxiety was minimised due to her ability to cognitively re-appraise the situation she was in. This process may share some resemblance with 'mindfulness' used in cognitive therapy, which pertains to "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p.145). Mindfulness has been used to ameliorate stress, depression and other psychiatric disorders in various clinical populations (Ledesma and Kumano, 2009; Chiesa and Serretti, 2011; Manicavasgar, Parker and Perich, 2011; Piet and Hougaard, 2011). Mindfulness can be used as an emotion regulation strategy, which has been suggested to utilise attentional processes to recruit activation in the prefrontal cortex, which modulates activity in the limbic area (Ochsner & Gross, 2005; Farb et al., 2007; Rolls & Grabenhorst, 2008). It is important to note that the mindfulness strategy in client B's music therapy sessions may deviate from the same strategy used for patients who do not have cognitive impairment. This is due to B's impaired ability to retrieve information of her own accord and needs the therapist to use verbal prompts to prime her memory recall. Therefore, this underscores the therapist's utilisation of his knowledge of B' personal history, including significant life events and personal preferences. Furthermore, it also stresses the need for the therapist to identify B's remaining cognitive functions and the taxonomy of each cognitive domain. For example, the therapist understood that B retained less impaired semantic memory, which allowed her to maintain some mental representation of facts, including time, day, the names of her family members and self-referential information. Therefore, the therapist was able to utilise these aspects of semantic memory to re-orientate B when she became anxious and disorientated. Interestingly, offering B a cup of tea was an effective strategy used by the therapist and care staff to distract and help B settle when she became anxious to find her family. This might be due to B being able to conceptualise what a cup of tea meant. Also, the prospect of having a cup of tea might have evoked the associated feeling of reward. Understanding which types of memories are still in use by dementia patients may allow therapists to deploy appropriate verbal strategies as soon as patients' symptoms have appeared.

Another important feature in the music therapy sessions was the therapist's bodily and facial expressions embedded in his musical and verbal expressions. These visual cues, such as the therapist's leaning towards the clients, eye contact, gaze and smile, were used to support the verbal and musical auditory cues to enhance the clients' emotions, attention and musical movements. In the current study, client A's video excerpt 1 (Entraining to 4/4 time) in 5.3.2 provided an example of this. The therapist used his movements to enhance A's entraining movements to the beat and used expansive movements to cue the slow-down cadence. Using bodily expressions was supported by the notion that non-verbal emotional communication is enabled through multimodal sensory integration (Kreifelts et al., 2007). Peelen, Atkinson and Vuilleumier (2010) further explain that "the importance of understanding other people's minds is reflected in the exceptional ability of humans to infer complex mental states from subtle sensory cues. In the domain of emotion, these sensory cues come from various sources, such as facial expressions, body movements, and vocal intonations" (p.10129). Therefore, visual cues from therapist's body and face may be essential in supporting musical and verbal cues in facilitating clients' emotion detection and the process of emotion regulation in music therapy.

Apart from the use of these verbal and nonverbal expressions, the video analysis of the current study also indicated the importance of the timings for the therapist to use his expressions and knowledge about the clients in the therapy sessions (Table 8.1 Five temporal themes). The therapist was found to use these expressions mostly when the clients' attention decreased or symptoms occurred during the sessions. Video excerpt 12 (Semantic form of self-knowledge in de-escalating emergent anxiety) provided an example of this (see section 6.3.4). In this excerpt, client B displayed signs of anxiety and wanted to find her family as soon as the therapist had finished singing and playing a known song. The therapist timely responded to B with his verbal expressions, which directed B's attention to processing semantic self-referential information as he knew that B could still retrieve certain forms of semantic memory. The results regarding timings from the video analysis, again, stressed the flexibility required in using the therapist's expressions and understanding of the client's history and functioning in a timely manner. Therefore, this may draw a line between music therapy and other music-based interventions (Lord and Garner 1993; Ragneskog et al. 1996; Denney 1997; Clark, Lipe and Bilbrey 1998; Gerdner 2000; Remington 2002; Sung. et al. 2006), which employ an itinerary of singing, instrument playing or music listening during a session and may not consider flexibly switching into using verbal intervention to activate clients' cognitive processes when music has failed to engage patients.

Taken together, the finding of the current study indicates that how the therapist used his own expressions played a key role in regulating clients' emotions. More specifically, verbal expression may be utilised as a top-down emotion regulation strategy (reducing emotional reactivity by using higher cognitive functions, such as thought, volition and interpretation) whereas music, bodily, facial and vocal expressions, may be utilised as a bottom-up emotion regulation strategy. Bottom-up regulation can be described as a “direct modulation of emotion-generative brain regions without the activation of “higher” brain regions, such as the prefrontal cortex, implicated in cognitively reappraise emotionally salient stimuli” (Chiesa, Serretti and Jakobsen, 2013, p.83). In the current study, whether to use down or up-regulation strategies depended on the patients’ various residual functions as well as what symptoms were presented and how they were manifested in the moment. The understanding of the clients’ personal history and functioning provided the therapist with a template to flexibly devise and deploy appropriate regulation strategies as soon as the symptoms arose during the sessions.

Drawing from the above findings, the current study showed that how the therapist’s used his expressions to dissipate the clients’ emergent symptoms during therapy could provide the care staff with examples of managing the care home residents’ neuropsychiatric symptoms in daily caregiving. This link between individual music therapy and caregiving was demonstrated in the feasibility study of the current study by showing video excerpts to the care staff as well as addressing the possible causes of symptoms. The quantitative results of the feasibility study supported the rationale of this intervention by showing a continuous trend of the residents’ decreased symptoms. These quantitative results could be explained using the qualitative results of the semi-structure interviews with carers, which reported carers’ enhanced awareness of symptom causes and interaction skills. Furthermore, the video analysis incorporating the analysis of heart rate and heart rate variability showed that the therapist modulated the clients’ mood by using the clients’ remaining cognitive and sensorimotor functions. This finding supports the systematic video observation by Raglio et al. (2015), which suggested that patients’ increased musical communicative behaviours in the videoed sessions might be attributable to changes in the emotional involvement and the improvement of the therapist-client empathetic relationship. The finding of the current study also supports the view of arousal regulation in music therapy (Ridder, 2003; 2011; Ridder and Adridge, 2005b; Ridder et al., 2013; Ridder and Wheeler, 2015). However, the current study broadens this view by adding the concept of emotion regulation (Gross 1998, 1999, 2002; Gross and Thompson 2007) into individual music therapy, which includes regulation strategies, such as attentional deployment, cognitive change and response modulation. This highlights the use of non-music strategies, such as verbal cues to prompt memory recall and audio-visual cues to activate attentional processes, in individual music therapy sessions.

All in all, the current study reports the phenomenon of emotion regulation in individual music therapy sessions. Emotion regulation may be the core therapeutic task in individual music therapy that distinguishes music therapy from music activities due to its link with caregiving, where therapists' understanding of clients' history and functioning as well as the timings of using various emotion regulation strategies play a crucial role.

## 9.3 Limitations of the study and implications for future research

There are challenges in conducting trials of psychosocial interventions in dementia long-term care settings (Vernooij-Dassen et al., 2010). The limitations of the trial in the current study are believed to be mainly due to it being undertaken on a smaller scale, due to being a feasibility study. The small sample size and resulting insufficient data led to the exclusion of the factor Home in the statistical analysis. This limits the test power to detect between-group differences, despite the statistical significance in some of the results. Furthermore, due to the exploratory nature of the feasibility study, no multiple outcomes or sample size calculation were performed. Therefore, the results should be interpreted with a level of caution. In addition, the large effect sizes (>0.8) are also difficult for interpretations of any clinical significance. Another constraining factor to the sample size was the availability of the day of the week for carrying out the intervention. During the trial, one home received one day per week of music therapy input and the other home received two. This restricted the number of residents receiving music therapy, considering the amount of time required for the music therapists to carry out the therapy sessions, review video recordings and present to the staff on the same day. This consideration was also taken into account during the recruitment process and contributed to the low recruitment rate for the resident participants (22 %, 17 out of 75 assessed for eligibility). For future studies, more music therapy days per week and increased staffing for conducting observations should be sought for each participating home. This, along with modified inclusion criteria, will allow a higher recruitment rate for resident participants. Issues with the randomisation were also encountered. The randomisation was administered to units within the homes. This could have caused contamination across the control and intervention groups. Although staff participants were advised to only work within the unit they were randomised to, there was no guarantee of this due to occasional staff shortages. In a follow up study, cluster randomisation would need to be administered to homes instead of units.

Video presentations to the staff in the intervention group were thought to be the key element in detecting the difference of symptom management between intervention and control group. However, some degrees of the Hawthorne effect (Landsberg, 1958) could have been generated when the staff who received the presentations also provided outcomes for the NPI. This should be rectified in a follow up study by recruiting another group of staff in addition to the intervention and control groups. The staff group who work with the residents should be blinded and provide outcomes without receiving any intervention. As previously stated, the number and length of the DCM observations were limited due to the availability of time, days and observer in the week for data collection. This might have not captured an accurate representation of the course of residents' wellbeing over time. More flexibility in scheduling for intervention and data collection should be considered in the design of a follow up study.

Some challenges were also involved in the mixed-method case study. The limited number of the videoed sessions and the corresponding heart rate measurements was believed to be a major issue. This prevented the performance of inferential statistical analysis for the heart rate and heart rate variability. Further issues regarding the fidelity of heart rate measurement were also implicated. Firstly, there have been some conflicting views regarding heart rate variability of patients with dementia. Aharon-Peretz et al. (1992), Giubilei et al. (1998) and Nonogaki et al. (2017) reported decreased heart rate variability in patients with Alzheimer's dementia whereas Allan et al. (2005) found no differences in heart rate variability between healthy subjects, patients with Alzheimer's and vascular dementia. Secondly, Heart rate variability signals are usually imperfect, particularly in ambulatory recording, which was employed in the current study. Ambulatory recording differs from stationary recording in a laboratory, in which heart rate variability is recorded with pre-determined durations and when subjects are in a steady condition. The two clients in the current study had their heart rate recorded whilst engaging in music therapy sessions. Their engagements in singing, moving to music and playing instruments could last differently in duration. Ambulatory recording can contain disturbances of either technical or physiological origins. Technical artifacts can be caused by poorly fastened electrodes, the person moving or missing beats or beats whose onset cannot be clearly defined. Physiological artifacts could be caused by premature atrial and ventricular contractions. These artifacts can introduce bias into HRV data and impair the reliability of HRV power spectrum by introducing false frequency components (Peltola, 2012). Thirdly, the validity of the heart rate measurements in the current study was compromised due to the very short measurements and their variable durations. As mentioned earlier, each time segment of the clients' engagement in singing, music listening, instrument playing and movement can vary in length (see section 7.2) and some of these segments only lasted just over 1 minute. Although the current study had only included the time segments lasting more than 1 minute in order to proceed with reliable frequency domain analysis for high frequency (HF) estimates (Task Force of the European Society of Cardiology, 1996), some shorter time segments, which lasted just over 1 minute, were still not suitable for indicating other indices of heart rate variability; for example, 2 minutes were recommended for low frequency (LF) estimates (ibid, p.634). Another issue related to the ecological ambulatory design (see section 3.6.5) was that there was no wash-out period between these time segments in the real-life therapy sessions. Therefore, the clients' heart rate and indices of heart rate variability in one time segment could have received an influence from the previous segment. For example, during video excerpt 2 (see section 5.3.3), client A's heart rate decreased and her heart rate variability increased whilst receptively listening to the therapist's singing a calming tune 'The Ash Grove'. This physiological phenomenon in excerpt 2 might not simply be a result of the calming music produced by the therapist. It could also have been a result of client A's motor activity, which was reduced from the prior time segment when she actively engaged in playing the drum and cymbal alongside the therapist's playing and singing an upbeat tune, 'Bye Bye Blackbird'. Therefore, this suggests the challenge in using an ecological ambulatory approach, as opposed to laboratory experiments, to deduce the causal links between stimuli and physiological phenomena in real life situation. On the other hand, this highlights the temporal dynamics of emotion regulation. As an emotion can unfold over a series of stages that are temporally overlapping and unidirectional (Phan and Sripada, 2013, p.376), attempts to regulate emotion are iterative, additive and synergistic (ibid, p.379). As a neuroanatomical manifestation of this, Kalisch (2009) found that frontal brain activity shifted from left to right and from posterior to anterior as the duration of emotion regulation increased. This suggests a dynamic process of down regulation using emotional reappraisal. Therefore, it may support music therapists, who are in need of engaging clients in a series of musical activities or verbal exchange to be able to achieve certain therapeutic goals. The synergy of music therapy techniques would deserve further testing in a more controlled laboratory setting. However, future research testing these techniques may need to consider temporal dynamics when defining the experimental paradigms.

## 9.4 Applications and implications in clinical practice

The findings of the study echo the importance of staff education and training, which may be the most effective method in managing symptoms of dementia (Livingston et al., 2005), and how music therapists can play a valuable role in this context. This role may be particularly helpful in training care staff to use tone of voice, rhythm, melody and nuanced gesture to communicate with people with dementia (Beer, 2016). However, it is cautious to note that the findings of the study also suggest times when music can fail to be a tool to facilitate interaction with persons with dementia. Moreover, care staff might not always have been equipped with music therapists' equivalent musical skills. Therefore, the role of music therapists may need to be extended to increasing care staff awareness of symptom preventative and copying strategies that are not solely music-focused. This would shed light on the proficiency of music therapists as clinicians, rather than musicians with good interaction skills. Upon this notion, music therapists' continuing post-qualification training, particularly the theoretical understanding of brain functions and neuropsychological domains of cognition may be a supporting factor for allowing music therapists to explain clients' health and provide practical methods of symptom management, taking neuroscientific research findings into account**.** These can be implicated in some aspects of music therapists' training and clinical practice in the field of dementia care. These aspects may cover referral and assessment processes, music therapy techniques and post-therapy communication. Additionally, the findings of the current study were also implicated in organisational policy making, the national campaign for music therapy provision in all dementia care settings and further research development. These will be discussed as follows:

### 9.4.1 Referral

Helping care staff in care homes identify appropriate referrals for music therapy is an important element in music therapists' role. However, the prioritisation of referrals could be challenging at times due to the number of potential music therapy recipients in a care home and availability of funding in music therapy provision. Using validated outcome measures, such as Neuropsychiatric Inventory (NPI) (Cummings et al., 1994) and Cohen-Mansfield Agitation Inventory (CMAI) (Cohen-Mansfield et al., 1989) could be helpful in assessing levels of residents' neuropsychiatric symptoms and need for therapeutic inputs. For example, level of agitation could be significant if a resident scores 39 or over on CMAI or over 4 on NPI (Livingston et al., 2014, p. 12). Additionally, it may be crucial to establish staff views during the referral process. For example, how symptomatic behaviours cause difficulties or disruption to staff work routine may provide music therapists with a picture of how music therapy can potentially help. The interview questions included in CMAI and NPI can help establish staff views.

### 9.4.2 Music therapy assessment and evaluation

As a resident's residual functions may serve to regulate emotions and mood, the goal of music therapy assessment may pertain to establishing how these functions are still in use. This pertains to identifying how a resident responds to various visual and auditory sensory inputs provided through therapists' musical, verbal, vocal, facial and bodily expressions. Importantly, therapists' knowledge of the neuropsychological domains of cognition may play a vital role in identifying the causal links between sensory inputs and a resident's motor outputs or mental processes. For example, attention includes domains such as alertness, vigilance, orienting response as well as focused, selective and alternating attention (Sohlberg and Mateer, 1989). A resident's entrainment to musical beat may suggest the involvement of implicit (automatic) selective attention (Grahn and Brett, 2007; Grahn and Rowe, 2009; Vuust et al., 2009), which may be utilised to enhance emotions. Also, the functioning of memory can also be identified through musical memory, which encompasses "autobiographical record (episodic memory; the context in which a piece was heard), knowledge about the world (semantic memory; recognition of a familiar tune) and learned motor skill sequences (procedural memory; playing an instrument)" (Clark and Warren, 2015, p. 2123). By establishing these residual functions, therapists may determine the helpfulness of music therapy and maximise the potential of the music therapy sessions following on from initial assessment.

Over a course of music therapy treatment, continuous tracking of these residual functions may provide insight into a resident's deterioration rate and allow therapist to adjust their methods in maintaining a resident's engagement in music therapy. NPI and CMAI may be used to evaluate the effect of music therapy on neuropsychiatric symptoms. However, other validated outcome measures assessing quality of life, mood, global functions and daily living skills (Moniz-Cook et al., 2008), may also be used in conjunction to establish the interrelation between biopsychosocial factors that may influence symptoms.

### 9.4.3 Clinical skills and knowledge in therapy

Dementia is a syndrome manifested by neurodegeneration in the brain. Therefore, it stresses the need for music therapists working in the field of dementia care to acquire knowledge and skills based on neuropsychological mechanisms. The findings of the current study support this notion by indicating that the therapist's interaction with the care home residents was not solely an arbitrary interaction, which could happen in any real life situations. This therapist-resident interaction involved the therapist's awareness of strategically employing his expressions, which were underpinned by cognitive-behavioural research findings. For example, improvisation could be used to enhance emotions through utilising repetition to generate predication, violation, surprise and feeling of reward. However, the repetition may need to be manifested with an eight-bar musical form, which consists of theme A and B. By either using the combination of AABB or ABAB, inserting contrasting rhythmic patterns and upwards-downwards melodic contour between A and B parts may intensify a person's recognition of pattern similarity, which involves working memory with main activation in frontal parts of the brain (Neuhaus, 2013). Similar mechanisms may be applied in the use of verbal cues. For example, offering a cup of tea to a resident with dementia, who is unsettled in mood, may induce reward anticipation and reward-motivated behaviour. This could involve the activation of the dopaminergic regions, such as the striatum and midbrain structures (Abler et al., 2006; Tobler et al., 2007) via the dorsolateral prefrontal cortex (Ballard et al., 2011). Moreover, asking how a resident would like her tea may engage the retrieval of self-referential semantic memory, which has been thought to recruit activity in the medial prefrontal cortex, a region also involved in memory, decision making and emotion regulation (Etkin, Egner and Kalisch, 2011; Euston, Gruber and McNaughton, 2012). These verbal cues could all serve as an emotion regulation strategy (distraction) when symptomatic or emergent anxiety appears. Other examples of using musical or vocal timbre, eye contact and body leaning direction could involve other neuropsychological mechanisms in the process of emotion regulation. Therefore, music therapists working in this field would need to continuously acquire new knowledge from the latest research findings. This may not only update the clinical skills required but also provide a language to explain the purpose of music therapy techniques to other health professionals, who may relate to evidence-based explanations.

### 9.4.4 Communication with care team

According to the findings from the current feasibility study, post-therapy communication with care staff could be a key factor in prolonging the effects of individual music therapy. This communication is also where music therapists bring their clinical expertise to the care team in care homes. This expertise may pertain to therapists' finding of how a resident responds to interpersonal and environmental stimuli and how these stimuli can be utilised to manage symptoms and enhance wellbeing on a long term basis. Music therapists' observation of a resident's functioning may also contribute to the tracking and staging of dementia and the multidisciplinary team's decision making for individualised care. However, there are challenges in a care home setting that could prevent this communication from taking place and generating the anticipated effects. Among the challenges, including the shortage of staff time, the most arduous process may be enabling care staff to witness residents' change in therapy as well as keeping them interested in understanding music therapy. Instead of using paper or computer-based documentation, the current study chose to present video clips to the staff, as this method offered time efficiency, tangible examples of symptom management and, most importantly, an emotional impact on the staff when they were surprised to see what they had not seen in a resident. However, it is also cautious to note that the video clips on their own might not suffice to induce a change in staff behaviour, awareness and thinking in their care delivery. The therapists' explanation of the videos, which shed light on symptom preventative and copying strategies, might have been essential to enhancing the emotional impact brought by the videos. Once again, this stresses music therapists' clinical knowledge of neuropsychological needs required in their practice and the application of this knowledge in the communication with the care team. Furthermore, the ability to switch between using a plain language and a language with theoretical and evidential underpinnings to explain phenomena in therapy sessions to different health care professionals may be pivotal in successful communication. Dementia care organisations that employ music therapists might need to consider providing specialist training in neuropsychological health if their employees' music therapy training has not fully covered this clinical area.

### 9.4.5 Policy and research

One major insight from the findings of the current study is that music therapy can potentially go beyond the therapy rooms in order to enhance multidisciplinary care planning and delivery in dementia care homes. This may contribute to better quality of care and life for care home residents with dementia. This insight has been recognised by the chartiable organisation, MHA, where the current study was carried out**.** As a result, MHA has strategized for increasing the provision of music therapy in the organisation's care homes, which provide a dementia care service (MHA, 2016). This has not only led to further employment of music therapists but also a change in the organisaion's policy making. Currently, the organisation is renewing its policy in order to embed music therapy in daily care. This would involve developing new policies and procedures to ensure regular music therapist-carer communication and incorporating music therapy introduction in staff induction training across the organisation. Moreover, the findings of the study have been presented at several conferences, including a keynote presentation at Anglia Ruskin University's music therapy and dementia care conference – the first UK-based conference focused on these two topics (Anglia Ruskin University, 2015). The results from the current study also have contributed to other important dialogues, such as the UK Parlimentary rountable discussion of music therapy in dementia care and the consultation process of developing new NICE guideline for dementia. The author of the current study has also contributed to the research designs of potential EU- and UK-funded research projects. It is envisaged that the current study will continue to shed light on the role of music therapists in dementia care settings and help campaign for increasing music therapy provision in dementia care services.

## 9.5 Conclusions

The feasibility trial study in the current project addressed the process of the development and delivery of a music therapy programme that incorporated the involvement of care staff in managing neuropsychiatric symptoms of dementia for care home residents. The programme highlighted the importance of music therapist-carer communication in order to maximise the effects of weekly active music therapy on the residents' care, wellbeing and symptom management. The results identified the role of music therapists not only in delivering the sessions but also in providing knowledge and skills that are clinically relevant to care delivery. The results of the study suggested potential sustained benefits on residents' wellbeing and symptoms over the 5 month period of intervention and two month period post-intervention. With modifications in the study design, the protocol warrants a more rigorous evaluation in a larger RCT. The current study also presented two contrasting mixed-method case studies, which reported two trial participants' change of heart rate, heart rate variability and behaviours as part of the phenomenon of emotion regulation in therapy. This research is at an early stage of development. However, exploring the feasibility and challenges in the work provides a picture that approximates the reality of day-to-day life and care in dementia care homes. This is useful in planning and delivering broader innovative therapeutic inputs to improve the wellbeing of people with dementia in care homes. Future research should endeavour to satisfy similar ecological validity. The working mechanisms of music therapy sessions still await scientific investigation. The use of more advanced psychophysiological measures may illuminate the concept of emotion regulation in music therapy and the agents of change acting on residents' internal states within sessions. This will help further clarify the clinical utility of music therapy in dementia care.

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